Study Scheme and Syllabus of Integrated Certificate Diploma Programme (ICD)

Mechanical Engineering Department

Sant Longowal Institute of Engineering and Technology, Longowal

(Established by MoE, Government of India)

Programme Outcomes (PO)

Mechanical Engineering Certificate/Diploma holders of Sant Longowal Institute of Engineering and Technology, Longowal (Deemed University) will have ability to:

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems
2. **Problem analysis:** Identify and analyse well-defined engineering problems using codified standard methods
3. **Design/development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements
5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices
6. **Project Management:** Use engineering management principles individually as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities
7. **Life-long learning:** Ability to analyse individual needs and engage in updating in the context of technological changes

Program Specific Outcomes (PSOs) – ICD (Mechanical Engineering)

1. The students will acquire abilities to apply knowledge of science and mechanical engineering by way of using the techniques and modern engineering tools for solving engineering problems.
2. The students will develop professional and entrepreneur skills along with becoming ethically responsible, besides recognizing the need for engaging in life-long learning.

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Summer-I							
S.No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1	TPID101	Summer Training (2 Weeks)	-	-	24	24	3

Semester-III							
S.No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	PCME201	Manufacturing Processes	3	1	0	4	4
2.	PCME203	Thermal Engineering	3	1	0	4	4
3.	PCME205	Metrology & Mechanical Measurements	3	0	0	3	3
4.	PEME201	Trade specific -1	3	0	0	3	3
5.	PCME207	Engineering Materials and Metallurgy	3	0	0	3	3
6.	PCME209	Engineering Materials and Metallurgy lab	0	0	2	2	1
7.	PCME211	Thermal Engineering lab	0	0	2	2	1
8.	PCME213	Metrology & Mechanical Measurements lab	0	0	2	2	1
9.	AUCH201	Environmental Science	2	0	0	2	0
			17	2	6	25	**20**
10	QPME201	Trade Specific Training -1			8	8	**01**
11	EAA 201	Extra Academic Activity (A/B/C)	-	-	-	1	**1(S/US)**

Semester-IV							
Sl. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	PCME202	Strength of Materials	3	1	0	4	4
2.	PCME204	Fluid Mechanics	3	0	0	3	3
3.	PEME202	Trade specific -2	3	0	0	3	3
4.	PEME204	Trade specific -3	3	1	0	4	4
5.	OEME202	Open Elective-1	3	0	0	3	3
6.	PCME206	Strength of Materials Lab	0	0	2	2	1
7.	PCME208	Fluid Mechanics lab	0	0	2	2	1
8.	AUMH202	Essence of Indian Knowledge and Tradition	2	0	0	2	0
			17	3	4	24	**20**
9	QPME202	Trade Specific Training -2			8	8	**01**
10	EAA-202	Extra Academic Activity (A/B/C)	-	-	-	1	**1(S/US)**

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Study Scheme of Integrated Certificate Diploma Programme

Semester-I							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	BSMA101	Mathematics-I	3	1	0	4	4
2.	BSPH103	Applied Physics-I	2	1	0	3	3
3.	BSCY105	Applied Chemistry	2	1	0	3	3
4	HSMH101	Communication Skills in English	2	0	0	2	2
5.	BSPH107	Applied Physics-I Lab	0	0	2	2	1
6.	BSCY109	Applied Chemistry Lab	0	0	2	2	1
7	HSMH105	Communication Skills in English Lab	0	0	2	2	1
8.	ESME101	Engineering Graphics	0	0	2	2	1
9	ESWS103	Engineering Workshop Practice	0	0	4	4	2
10	HSSP103	Sports and Yoga	0	0	2	2	1
			9	3	14	26	**19**
11	QPME101	04 Nos of hr. per week AUTOCAD drawing 04 Nos of hr. per week Workshop training			8	8	**01**

Semester-II							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	BSMA102	Mathematics-II	3	1	0	4	4
2.	BSPH104	Applied Physics-II	2	1	0	3	3
3	ESCS102	Introduction to IT Systems	2	0	0	2	2
4	ESEE104	Fundamentals of Electrical Engineering	2	0	0	2	2
5	ESEC108	Fundamentals of Electronics Engineering	2	0	0	2	2
6	ESME106	Engineering Mechanics	2	1	0	3	3
7	BSPH106	Applied Physics-II Lab	0	0	2	2	1
8	ESCS110	Introduction to IT Systems Lab	0	0	2	2	1
9	ESEE112	Fundamentals of Electrical Engineering Lab	0	0	2	2	1
10	ESEC114	Fundamentals of Electronics Engineering Lab	0	0	2	2	1
11	ESME116	Engineering Mechanics Lab	0	0	2	2	1
			13	3	10	26	**21**
12	QPME102	04 Nos of hr. per week Machine Drawing 04 Nos of hr. per week Workshop training			8	8	**01**
13	EAA 102	Extra Academic Activity (A/B/C)	-	-	-	1	**1(S/US)**

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Summer-II							
S.No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1	TPID201	Industrial Training (6 Weeks)	-	-	24		03

Semester-V							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	HSMH301	Entrepreneurship and Start-ups	3	1	0	4	4
2.	PCME301	Theory of Machines	3	0	0	3	3
3.	PCME303	Industrial Automation and Control	2	0	0	2	2
4.	PEME301	Industrial Engineering & Management	3	0	0	3	3
5.	OEME301	Open Elective-2	3	0	0	3	3
6.	PCME305	Theory of Machines Lab	0	0	2	2	1
7	PCME307	Industrial Automation and Control	0	0	2	2	1
8	PEME303	Industrial Engineering & Management	0	0	2	2	1
7	PRME301	Minor Project	0	0	4	4	2
			14	1	10	25	20
8	QPME301	Trade specific Training -3			8	8	01

Semester-VI							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	AUMH302	Indian Constitution	2	0	0	2	0
2.	PCME302	CAD/CAM	3	0	0	3	3
3.	PEME302	Design of Machine elements	3	1	0	4	4
4.	PEME304	Estimation and Costing	3	1	0	4	4
5.	OEME302	Open Elective-3	3	0	0	3	3
6.	PCME304	CAD/CAM Lab	0	0	2	2	1
7.	PRME302	Major Project	0	0	8	8	4
8.	SEME302	Seminar	1	0	0	1	1
			15	2	10	27	20
9	QPME302	Trade specific Training -4			8	8	01

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LIST OF Trade specific courses.

Course Code	CTD (A)	CFF (B)	CWG (C)	CAF (D)	CAC (E)
PEME201	Tool Room Techniques-I	Foundry Technology-I	Welding Technology-I	Farm Machinery-I	Refrigeration & Air Conditioning-I
PEME202	Tool Room Techniques-II	Foundry Technology-II	Inspection and Testing of Weldments	Advanced Agricultural Equipments	Refrigeration & Air Conditioning-II
PEME204	Fundamentals of Tool and Die Design	Forging Technology	Welding Technology-II	Farm Machinery-II	Fundamentals of Heat and Mass Transfer

List of open electives.

Course Code	(A)	(B)	(C)	(D)
OEME202	Industrial Engineering	Fundamentals of Manufacturing	Production Management	Material Management
OEME301	Work Study & Ergonomics	Computer Aided Design	Safety Engineering	Robotics
OEME302	Additive Manufacturing	Computer Aided Manufacturing	Engineering Estimation & Costing	Supply Chain Management

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Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
HS	Humanities & Social Sciences Courses
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
AU	Audit Courses
SI	Summer Internship
PR	Project
SE	Seminar

QP Qualification Pack
TP Training Programme.

XX	EE (Electrical engineering)
	IE (Instrumentation Engineering)
	EC (Electronics & Communication Engineering)
	CS (Computer Science & Engineering)
	CH (Chemical Engineering)
	ME (Mechanical Engineering)
	FT (Food Technology)
	PH (Physics)
	CY (Chemistry)
	MA (Mathematics)
	MH (Management & Humanities)
	SP (Sports)

PCXX- YZZ

Y-stands for year code 1, 2 or 3

ZZ- odd for odd semester subject e.g. 101, 103, 201, 305 etc.

ZZ-Even for even semester subject e.g. 102, 112, 202, 306 etc

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SUMMARY

Table 1: Working weeks, days and hours in a semester				
Semester	Working Weeks / Semester	Working days/ Week	Working Hours/ Day	Hours/ semester
Odd	15	5	8	600
Even	15	5	8	600

Table 2: Relation of credits and hours in a week		
Description	Credits	Hours/ week
Theory/ Tutorial	1	1
Laboratory (Practical)	1(2)	2(3/4)
Training	1	8

Table 4: Total credits in a programme							
Programme	Total Credits	Theory		Laboratory		Training	
		Credits	%age	Credits	%age	Credits	%age
Vocational Diploma	180	72	40	18	10	12	50
Diploma	120	90	75	30	25	-	0-
ICD+Voc	135	93	70.45	27	20.45	12	9.10

Odd Semester		Even Semester		
Semester	Credit	Semester	Credit	
1	20	2	23	43
3	22	4	22	44
5	21	6	21	42
				129
		Summer-I	3	3
		Summer-II	3	3
				135

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Title of the Course	: **Engineering Graphics**		
Subject Code	: **ESME101**		
Weekly load	: 2	LTP	0-0-2
Credit	: 1		

COURSE OUTCOMES:

After successful completion of course, the students should be able to-

CO1: To understand various conventions, symbols, and methods of engineering drawing such as line, lettering, dimensioning, scales, etc.

CO2: Draw a geometrical construction of an orthographic view of points, lines and planes.

CO3: To enhance visualization about constructing the projections of various solids.

CO4: Develop the different surfaces and isometric projections.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	1	1	1	1	2	2	1	1
CO2	1	2	2	2	1	2	1	1	2
CO3	1	1	2	1	2	2	2	2	2
CO4	2	1	3	2	1	1	2	2	2
Avg.	1.5	1.25	2	1.5	1.25	1.75	1.75	1.5	1.75

Course Description	Lecture(s)
Unit-I	
Introduction	03
Introduction, Objectives, Applications. Fundamentals of engineering drawing, Use and handling of different drawing instruments, title block, sheet sizes, first and third angle projections, orthographic projections.	
Lettering and Dimensioning	06
Free hand sketching of different types of lines in engineering drawing as per IS specifications, Free-hand lettering (alphabet and numerals) - lower case and upper case, vertical and inclined at 75^0 in the ratio of 7:4, Notation of dimensioning, size and location dimensions, aligned and unidirectional systems of dimensioning, general rules for dimensioning, unit of dimensioning.	
Scales	03
Uses of scales, sizes of scale, representative fraction, construction of plain and diagonal scales	
Projection of points, line	05
Introduction on theory of projections and orthographic projections, projection of a point in different quadrants, projection of straight lines in different positions (all possible cases)	
Unit-II	
Projection of Planes	05
Definition of plane, types of planes, traces of plane, projection of planes in different positions	
Projection of Solids	05
Types of solids, projections of solids in simple positions, introduction on sectioning of solids	
Development of surfaces	05
Introduction, Development of a right prism, cylinder, pentagonal prism, and a right pyramid	
	Total = 32

Recommended Books:

Title	*Author(s)*	*Publisher*
Engineering Drawing	P S Gill	Kataria and Sons, New Delhi
Engineering Drawing	R.K.Dhawan	S. Chand & Co, New Delhi
Engineering Drawing	N.D.Bhatt	Charotar Publishing House

Title of the course	: **Engineering Workshop Practice**		
Subject Code	: **ESWS103**		
Weekly load	: 4	LTP	0-0-4
Credit	: 2		

COURSE OUTCOMES:

After successful completion of course, the students should be able to-

CO1: To identify and use basic safety precautions, working positions, equipment and tools of the workshops.

CO2: To perform simple operations like sawing, marking, planning, chiseling and making simple joints on wood.

CO3: To perform simple operations like cutting, chipping, sawing, filing, drilling, cutting, development, folding, bending, piercing, punching, parting, notching and slitting on metal, recognize defects in the jobs and perform simple forging conversions.

CO4: To perform upsetting operations, make welded and sheet metal joints, recognize different patterns and make green sand moulds.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	3	3	2	3	3	3
CO2	3	3	3	3	2	2	3	3	2
CO3	3	3	3	3	2	2	3	3	2
CO4	3	2	3	3	2	2	3	3	2
Avg.	3	2.5	2.75	3	2.25	2	3	3	2.25

List of Practical's (10-14) jobs from the following list:

CARPENTRY SHOP

- Making of various joints
- Cross lap joint
- T-lap joint
- Corner lap joint
- Mortise and tenon joint
- Dovetail joint

FITTING SHOP

- Study and use of instruments in fitting shop, like vernier caliper, micrometer and height gauge etc.
- Exercise on simple operations viz. cutting, chipping, sawing, filling, drilling etc.

FOUNDRY SHOP

- Familiarization with different types of patterns and hand tools
- Preparations of green sand mould using single piece pattern.
- Preparations of green sand mould using split piece pattern on bench molding.
- Preparations of green sand mould using solid piece pattern by bedded molding.

PATTERN SHOP

- Familiarization with different tools and patterns in the shop
- Exercise on making of solid piece pattern.
- Exercise on making of split piece pattern.
- Exercise on making of cored pattern.

SHEET METAL SHOP

- Study the layout and different equipment used in sheet metal shop.
- Familiarization with different tools and processes in sheet metal shop
- Exercise on cutting, development, folding, bending, piercing, punching, parting, notching, slitting etc,
- Profile and circle cutting exercise.

Title of the course	: **Engineering Mechanics**		
Subject Code	: **ESME106**		
Weekly load	: 3	LTP	2-1-0
Credit	: 3		

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Understand the basic laws of Engineering Mechanics

CO2: Identify and analyze the various forces acting on engineering component

CO3: Solve complex Engineering problems by applying mechanics laws

CO4: Understand and analyze the particle in motion

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	3	2	1	1	2	3	1
CO2	3	3	2	3	1	1	1	2	1
CO3	2	1	3	1	1	1	2	2	1
CO4	3	2	3	2	1	1	1	3	2
Avg.	2.75	1.5	1.75	1.75	1	1	1.25	2.75	1.25

Theory

Course Description	**Lecture(s)**
Unit-I	
Fundamental of Mechanics	
Fundamental concept of mechanics and applied mechanics Fundamental laws of mechanics, Force systems: Coplanar, concurrent and non-concurrent forces, Free body diagrams, resultant and resolution of forces ; Triangle, Parallelogram and Polygon law of forces, Condition of equilibrium, Lami's theorem, concept of equilibrium	05
Moments & Couples	
Concept of moment, Varignon's theorem, Moment of forces, concept of couple - properties and effect, Moment of couple, Parallel forces - like and unlike parallel forces, calculation of their resultant	06
Trusses	
Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints	05
UNIT II	
Friction	05
Concept of friction, Characteristics of Dry friction, Laws of Coulomb friction, limiting friction, coefficient of friction; sliding friction and rolling friction Ladder friction.	
Centre of Gravity	
Concept of gravity, centroid and centre of mass, centroid for regular lamina and centre of gravity for regular solids. Centroid of composite area.	05
Kinetics of particle	
Types of motion, linear motion with uniform velocity, uniform & varying acceleration, motion under gravity, motion of projectiles, relative motion of a particle. Newton's laws of motion, equation of motion, equation of motion for system of particles, Impulse momentum principle, Conservation of momentum, Introduction to Principle of work and energy, D' Alembert's Principle.	06
	Total=32

Recommended Books:

1. S. S. Bhavikatti & K. G. Rajashekarappa, Engineering Mechanics, New Age International Publishers
2. R. C. Hibbeler, Engineering Mechanics (Static & Dynamics), Prentice Hall
3. R. K. Rajput, Engineering Mechanics, Dhanpat Rai Publication, New Delhi
4. S. Rajshekharan, Engineering Mechanics, VIkas Publishing House, New Delhi

Title of the course	: **Engineering Mechanics Lab**	
Subject Code	: **ESME116**	
Weekly Load	: 02	LTP: 0-0-2
Credits	: 01	

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn and understand fundamentals of Mechanics

CO2: Acquire necessary skill to understand the principle of simple lifting machines

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	3	3	3	2	3	2
CO2	3	3	3	3	3	3	2	3	2
Avg.	3	3	3	3	3	3	2	3	2

List of Experiments:

1. To verify parallelogram law of forces addition.
2. To verify triangular law of forces addition.
3. To verify Lamis theorem.
4. To determine efficiency of screw jack.
5. To determine coefficient of friction on horizontal surface.
6. To determine coefficient of friction on inclined plane.
7. To determine efficiency of wheel and Axle.

Title of the course : **Manufacturing Processes**
Subject Code : **PCME201**
Weekly load : 4 LTP 3-1-0
Credit : 4

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Explain and analyze the various casting and metal forming process mechanics and evaluate the force and power requirements of forging, rolling and drawing etc.

CO2: Analyze mechanics of metal cutting and various aspects of tools used in the process of machining.

CO3: Illustrate and differentiate various super finishing operations.

CO4: Explain and distinguish different welding processes and nonconventional machining.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	2	1	1	2	3	1
CO2	3	2	1	2	1	1	1	3	1
CO3	2	1	1	1	1	1	1	2	1
CO4	3	1	1	2	1	1	1	3	2
Avg.	2.75	1.5	1.00	1.75	1	1	1.25	2.75	1.25

Course Description	**Lecture(s)**
Unit-I	
Introduction	
Definition, need of Manufacturing, Classification of Manufacturing Processes, Applications.	**02**
Metal Casting	
Sand Casting and Mould, Type of Patterns, Pattern Materials, Pattern Allowance, Molding Sand Properties and Testing, Core –Types and applications, Core prints, Molding Machines, Types and applications of Melting furnaces, Defects in Sand casting process-remedies; Principles of powder metallurgy.	**08**
Introduction to bulk and sheet metal forming	
Plastic deformation and yield criteria, fundamentals of hot and cold working processes, load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending)	**08**
Grinding & Super finishing	
Grinding: Grinding wheels, abrasive & bonds, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Surface and cylindrical grinding. Centreless grinding. Super finishing: Honing, lapping and polishing.	**06**
Unit-II	
Metal cutting	
Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, cutting tool materials, cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.	**08**
Metal Joining (Welding)	
Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding - spot, seam projection etc. Other welding processes such as atomic hydrogen, submerged arc, electroslag, friction welding. Soldering & Brazing. Adhesive bonding.	**08**
Unconventional Machining Processes	

Classification of Unconventional Machining Processes, Principles and process parameters - Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Electrochemical machining (ECM), Electrical Discharge Machining, Wire EDM; Laser Beam Machining (LBM). Introduction to Additive Manufacturing.	08

Total=48

Recommended Books:

1. Kalpakjian and Schmid, Manufacturing Processes for engineering materials (5th Edition)- Pearson India,
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems. -- Wiley
3. Manufacturing Technology by P.N. Rao., McGraw Hill India.
4. Materials and Manufacturing by Paul Degarmo, Wiley
5. Principles of Foundry Technology, Jain, McGraw Hill India.
6. Production Technology by RK Jain.

Title of course- : **Thermal Engineering**
Subject Code- : **PCME203**
Weekly Load : 4 LTP-3-1-0
Credit : 4

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: To understand Different Gas law, Thermal properties of gaseous and different system.

CO2: To learn about Thermodynamics equilibrium, zeroth and other thermodynamics law and different thermal process.

CO3: To understand basics concept of Steam formation and study of boilers.

CO4: To study Engine cycles, SI and CI Engine and their performance.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	2	2	3	1	2	3	1
CO2	3	2	2	2	3	1	1	2	1
CO3	2	2	2	1	3	1	2	2	1
CO4	3	2	2	2	3	1	1	3	2
Avg.	2.75	1.5	2	1.75	3	1	1.5	2.5	1.25

Course Description	**Lecture(s)**
Unit-I	
Introduction:	
Boyle"s Law, Charle"s Law, characteristics gas equation, universal gas constant Properties; intrinsic and extrinsic, system; open, closed and isolated.	05
Laws of thermodynamics:	
Thermodynamic equilibrium, Zero th law of thermodynamics, first law of thermodynamics, concepts of enthalpy, internal energy, specific heat, work and heat, concept of entropy, caluses and Kelvin plank statement of second law of thermodynamics, Equivalence of Kelvin plank and clausius statements. Throttling and free expansion, non-flow work done under isothermal, polytropic, adiabatic, isobaric, isochoric processes, simple problems steady flow energy and its applications	07
Formation of Steam	
Steam formation, wet steam, dry steam and saturated steam, dryness fraction, superheated steam; degree of superheat, latent heat of vaporization, Enthalpy of steam, entropy; entropy increase during evaporation, temperature entropy diagram mollier diagram (H-S diagram)	08
Steam Boilers	
Steam generator, Classifications, comparison of fire tube and water tube boilers, construction and features of Lancashire boiler, locomotive and Babcock and Wilcox Boilers, Introduction to modern boilers. Rankine cycle.	08
Unit-II	
Engine Cycles	
Carnot cycle, Otto Cycle, diesel and dual cycle, derivation of efficiency and comparison of these cycles.	07
I.C Engine	
Types, classification, CI and SI engines, Mechanical constructional details of two stroke petrol engine and diesel engine, four stroke petrol and diesel engines, valve timing diagrams.	06
Performance of IC engines	
Brake, indicated, frictional powers, brake mean effective pressure, indicated map, engine	07

efficiencies, air standard, brake, indicated, mechanical, volumetric ,scavenging, efficiency, characteristics of power, fuel consumption with engine speed, calculation of powers, efficiency and SFC for two and four stroke engine. LCV, HCV	

Total: 48

Recommended Books:

1. Thermal Engineering RK Rajput Laxmi publication.
2. Heat and thermodynamics PL Ballany Khanna Publisher
3. Thermal Scienec Domkundwar S.Chand Publisher
4. Heat Engineering Kumar and Vasandani S.Chand Publisher.
5. I.C Engine Ganesan McGraw Hill

Title of the course : **Metrology & Mechanical Measurements**
Subject Code : **PCME205**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn importance and fundamentals of measurements.

CO2: Conceptualizing work/surface properties and tolerance.

CO3: Understand the mechanism of working of measuring equipments.

CO4: Evaluate dimensions using measuring equipments.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	1	2	1	3	1	3
CO2	2	3	2	1	1	1	1	2	1
CO3	1	3	2	1	1	1	1	3	1
CO4	1	1	1	3	1	2	3	2	3
Avg.	1.75	2	1.5	1.5	1.25	1.25	2	2	2

Course Description	**Lecture(s)**
Unit-I	
Introduction	
Metrology and its objectives, need of inspection, physical measurement, precision and accuracy, accuracy and cost, trace- ability, selection of instruments, sources of errors, calibration, sensitivity, and readability, classification of methods of measurements.	07
Standard of Measurements	
Introduction, line standard and end standard, yard, meter, end bars, transfer from line standard to end standards.	05
Linear measurements	
Introduction, non- precision measurements, steel rule, outside and inside calipers, surface plate, angle plate, V-block, straight edges, combination set, vernier instruments, micrometer, depth and height gauges, thread micrometer, slip gauges and their uses.	07
Measurements of work properties	
Straightness, flatness, squareness, parallelism, circularity, surface finish, their tests, and measurements.	05
Unit-II	
Limits, fits and tolerances	
Introduction, tolerances, concept of interchangeability, limits of sizes, Indian standard tolerance zone shaft, hole, basic shaft, basic hole, clearance, interference, commonly used fits, Taylor's principle, "Go" and "No Go" gauges, plug gauges, ring gauges, snap gauges, limit gauges, gauges for tapers.	08
Comparators	
Introduction, mechanical and electrical comparator, their uses, advantages, and disadvantages.	06
Metrology of screw thread	
Introduction, screw terminology, measurement of elements of screw threads, major diameter, minor diameter, thread micrometer, two wire method, three wire method.	05
Measurement of gears	
Introduction, terminology of gear tooth, measurement of profile, spacing pitch, thickness of tooth, backlash, gear tooth vernier caliper	05
	Total=48

Recommended Books:

1. I.C. Gupta, Engineering Metrology, Dhanpat Rai Publication
2. R. K. Rajput, Engineering Metrology and Instrumentation, Katson Books
3. Nakra & Chaudhary, Instrumentation, Measurement & Analysis; Tata McGraw Hill
4. T. G. Beckwith, L.N. Buck and R. D. Marangoi, Mechanical Measurements; Addison Wesley Reading

Title of the course : **Tool Room Techniques - I**
Subject Code : **PEME201 (A)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Understand different clamping and fixture tools.
CO2: Analyze practical skills in various machining operations.
CO3: Understand the concept of powder metallurgy and their applications.
CO4: Apply different sheet metal operations.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	1	1	1	1	1	2
CO2	1	3	1	1	1	1	1	2	2
CO3	2	1	1	1	1	1	1	2	1
CO4	2	3	1	1	1	1	1	3	2
Avg.	2	2.25	1	1	1	1	1	2	1.75

Course Description	**Lecture(s)**
Unit-I	
Engineering materials-Ferrous and non-ferrous material, properties of material. Limits, fits & Tolerance terminology as per Latest IS 919 Combination of hole and shaft for a particular fit, Geometrical accuracy and tolerances by machining process. Table for tolerance zones and limits.	6 Hrs
Tool and cutter Grinding Machine and classification, constructional features. Grinding Wheel – types& shapes-Specification-size Description of single point cutting tool. Tool angles and its importance. Effects of tool setting and tool angles. Study of different angles of single point Lathe tool	6 Hrs
Lathe–types-classification – constructional features, accessories, operation, application and specification. Different cutting tool materials-Milling cutters	6 Hrs
Cutting tool Geometry and their function. Calculation of CS-RPM-feed-depth of cut and machining time. Cutting coolant-Types-Functions-Characteristics-Applications and its importance.	6 Hrs
Unit-II	
Introduction to jigs & fixtures. Principles of jigs & fixtures design, Location & principles of location, different elements of a jig, locating devices. Clamping, devices. Jig bushes, drilling jigs. Milling fixtures. Turning fixtures.	6 Hrs
Introduction, types of broaches, classification, pull type & push type, horizontal & vertical pull type broaching machines	6 Hrs
Introduction, process of powder metallurgy, advantages & applications of powder metallurgy.	6 Hrs
Metal chipping & cutting, chipping tools, chipping techniques, Scrapping, filing Operations, cutting of external threads.	6 Hrs
	Total=48

Recommended Books:

1. Workshop Technology(Vol-1) Chapman CBS
2. Production Technology R. K. Jain Khanna

3. Jigs & Fixtures Gant TMH
4. Workshop Technology Vol.I & II Hajra Choudhary Media Promoters
5. Workshop Technology Vol.I & II B. S. Raghuvanshi Dhanpat Rai

Title of the course : **Foundry Technology-I**
Subject Code : **PEME201 (B)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to
CO1: Learn the fundamentals of foundry, materials, patterns, and associated safety factors.
CO2: Study about foundry materials.
CO3: Study about different mould making and core making.
CO4: Study about different types of gating system and risers.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	2	1	1	2	1	2
CO2	3	3	3	3	2	3	3	2	3
CO3	3	2	2	2	1	2	2	1	2
CO4	3	2	2	1	1	2	2	1	2
Avg.	3	2	2	2	1.25	2	2.25	1.25	2.25

Course Description	**Lecture(s)**
Unit-I	
Introduction	**12**
Various foundry processes their capabilities and safety requirements in foundry, concept of mould, constituents of flask equipments, risers, runners, pouring basins, sketching of mould along with its components, type of mould, molding methods, type of patterns, BIS color coding, materials and allowances	
Mould Materials	**12**
Properties of moulding sand, different types of moulding materials, additives, natural and synthetic binding agents	
UNIT-II	
Mould Making	**09**
Making of cope and drag, chaplets, mould sealing, preservation of making mould, bench life, moulding defects	
Core making	**09**
Definition and preparation of cores, type of cores, setting of cores, core making and baking, reinforcement of core, painting and venting of cores, core boxes and core prints.	
Gates and risers	**06**
Introduction to gating systems and their functions, types of different risers and their functions.	

Total=48

Recommended Books:

1. Principle of foundry technology by PL Jain, Khanna Publishers.
2. Foundry Technology by M.Lal and O P Khanna, Dhanpat rai and sons.
3. Foundry Technology by Srinivasan, Khanna Publishers.
4. Principles of metal casting, Richard W Heine, By TMH Publishers.
5. Metal casting Technology by PC Mukherji, Oxford and IBH Publishers.

Title of the course : **Welding Technology - I**
Subject Code : **PEME201 (C)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn fundamentals of welding processes.

CO2: Select a suitable welding process for a particular application.

CO3: Identify and select welding parameters.

CO4: Apply safety measures during welding operations

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	1	1	1	3	1	1
CO2	1	2	2	1	1	1	1	2	1
CO3	1	2	3	2	1	1	1	2	1
CO4	1	3	3	2	1	1	3	3	2
Avg.	1.5	2	2.25	1.5	1	1	2	2	1.25

Course Description	**Lecture(s)**
Unit-I	
Introduction	
Introduction to various fabrication processes, definition of welding, importance of welding as compared to other fabrication techniques, classification of welding and allied processes.	04
Welding Safety and Hazards	
Hazards associated with gas and arc welding processes, protection against electric shock, arc radiation, fumes, and dust.	06
Types of welded joints	
Concept of edge preparation & different types of groove design, role of thickness in edge preparation, types of welds and welded joints for various welding processes, welding positions.	08
Shielded metal arc welding	
Principle of SMAW, welding arc and its initiation, static arc characteristics, power sources for SMAW, equipment and accessories required for SMAW process, welding parameters and their effect on weld bead geometry, classification of electrodes and electrode coatings, AWS and BIS codes for the electrodes.	06
Unit-II	
Gas welding	
Principle of gas welding, types of the fuel gases and their properties, equipment detail, cylinders torches and regulators, their constructional features and operational details, types of flames and their characteristics, gas welding techniques, filler material and fluxes.	08
Soldering and brazing	
Basic principle of soldering & brazing, types of solders, soldering and brazing techniques, role of flux and the types of fluxes, applications of soldering and brazing, braze welding. Advantages and limitations of each.	08
Resistance Welding	
Basic principle, brief introduction to spot, seam, projection and flash butt welding, welding variables, resistance welding equipment, heat balance, applications, process capabilities.	08
	Total=48

Title of the course : **Farm Machinery-I**
Subject Code : **PEME201 (D)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Understand the importance of farm power and mechanisation.

CO2: Understand the phenomenon of tillage and equipments used for this purpose.

CO3: Use the various shaping and leveling equipments for land development.

CO4: Learn about seeding process by utilizing various seeding equipments.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	2	3	2	3	2	2
CO2	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	2	3	3	3	3

Course Description	**Lecture(s)**
Unit-I	
Farm Power and Mechanisation	
Status of farm power in India, sources of farm power, Farm mechanization and its importance in the advancement of agriculture engineering/ technology, Categorization of farm machinery and equipment. Some numerical problems.	**10**
Ploughing & Tillage equipment's:	
Tillage, Primary tillage: working principle, construction, mode of operation, specifications of Indigenous plough, mould board plough and disc plough. Secondary Tillage: Introduction, types, working principle, construction, mode of operation, specifications of Harrow, Cultivator, Hoes and rotavator.	**14**
Unit-II	
Shaping and leveling equipment's:	
Introduction, types, working principle, construction, material adjustment, mode of operation, specifications of scraper, riddger, leveller, bund former.	**04**
Equipment's for land development	
Mechanical working of soil, mechanical methods land grading, shaping & leveling, planning of operation, earth moving equipment's, computerized land leveler.	**08**
Seeding equipment's	
Introduction, types, working principle, construction, material adjustment, mode of operation, specifications of: furrow opener, calibration of seed cum fertilizer drill, specification of different types of metering devices. Some numerical problems	**12**
	Total=48

Recommended Books:

Title	Author(s)	Publisher
Principles of Farm Machinery	Kepner	C. B. S
Farm Power Machinery & Surveying	Irshad Ali	Kitab Mahal
Farm mechanism & Farm Machinery & Power	O.P. Singhal	Orient Offset Printers
Elements of Agricultural Engineering	Jagdishwar Sahay	Standard publishers distributors

Recommended Books:

Title	*Author(s)*	*Publisher*
Welding processes & technology	RS PARMAR	Khanna Publishers
Principles of welding technology	LM GOURD	Edward Arnol
Welding technology	OP KHANNA	Dhanpat Rai
Modern arc welding	SV NADKARNI	Oxford & IBH

Title of the course	: **Refrigeration and Air Conditioning-I**	
Subject Code	: **PEME201 (E)**	
Weekly load	: 3	LTP 3-0-0
Credit	: 3	

COURSE OUTCOMES:

CO1: Understand the basic of refrigeration and A.C

CO2: Understand and develop skill to solve practical problems.

CO3: To learn about different refrigerant use in Refrigeration and Air Conditioning system. different thermal process.

CO4: To understand basics concept of Psychometric charts.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	2	2	3	1	2	3	1
CO2	3	2	2	2	3	1	1	2	1
CO3	2	2	2	1	3	1	2	2	1
CO4	3	2	2	2	3	1	1	3	2
Avg.	2.75	1.5	2	1.75	3	1	1.5	2.5	1.25

Course Description	**Lecture(s)**
Unit-I	
Air Refrigeration Systems	
Introduction, concept of refrigeration, units of refrigeration, air refrigeration systems, reversed control cycle, Bell Coleman air refrigerator.	**12**
Refrigeration Systems	
Vapor compression refrigeration system, COP. Performance of VCR, advantages and disadvantages, Methods for improving COP, Introduction, aqua ammonia absorption system.	**12**
Unit-2	
Refrigerants	
Classifications of refrigerants, properties of ideal refrigerants, anti-freeze solutions, selection of refrigerants, nomenclature of refrigerants. Ozone layer depletion, eco-friendly refrigerants.	**12**
Psychrometry and Air Conditioning Systems	
Psychrometry, Psychometric charts, Psychrometry Process, Simple numerical problem, Types of air-conditioning systems, central AC, unitary AC load circulation load calculation.	**12**
	Total-48

Recommended Books:

Title	*Author(s)*	*Publisher*
Refrigeration and Air conditioning	C. P. Arora	TMH
Refrigeration and Air conditioning	Domkondwar	Khanna
Refrigeration and Air conditioning	Balleney	Khanna
Ref and Air Conditioning	Gupta & Prakash	New Chand

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Title of the course : **Engineering Materials and Metallurgy**
Subject Code : **PCME207**
Weekly load : 3 LTP 3-0-0
Credits : 3

COURSE OUTCOMES:

After successful completion of course, the students will be able to:

CO1: Learn about engineering materials, their types, and properties.

CO2: Learn about crystal structures of metals and fabrication techniques used for plastics.

CO3: Learn and distinguish various ferrous and non-ferrous metals and their engineering properties.

CO4: Learn about plastic deformation in metals, phase diagrams and various heat treatment processes applicable to engineering materials.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	2	1	1	2	3	1
CO2	3	2	3	2	2	1	2	3	1
CO3	3	3	1	1	1	1	2	2	1
CO4	3	3	2	2	1	1	2	3	2
Avg.	3	2.5	1.75	1.25	1.25	1	2	2.75	1.25

Course Description	**Lecture(s)**
Unit-I	
Introduction:	05
Introduction to engineering materials, physical metallurgy, and basic concepts of heat treatment. Industrial importance of common engineering materials-metals, non-metals and alloys, their properties (physical and mechanical) and applications.	
Crystallography:	06
Crystalline nature of solids, Structure of atom, types of solids, space lattice arrangement of atoms in BCC, FCC, and HCP crystals.	
Ferrous and non-ferrous metals:	08
Classification of iron and steel; cast iron, alloy steel, stainless steel, and carbon steels. Aluminium and its alloys; copper and its alloys; nickel and its alloys; their physical and mechanical properties and applications.	
Engineering plastics:	04
Thermosetting and thermoplastics, fabrication techniques of engineering plastics, their properties, and applications.	
UNIT-II	
Plastic deformation of metals:	04
Plastic deformation of metals, strengthening mechanism of metals and their effect on mechanical properties.	
Phase diagrams:	09
Phases in metal system, solid solution, Hume-Rothery rules, solidification of pure metals and alloys, phase rule, equilibrium diagrams, Iron-carbon equilibrium diagram and effect of carbon on properties of steel.	
Heat treatment processes:	12
Principle of heat treatment of steels, TTT curves, annealing, normalizing, hardening, Case hardening, tempering, austempering, martempering, flame hardening, induction hardening, carburizing, nitriding, cyaniding of steels, Precipitation hardening with reference to Copper and Aluminum	
	Total=48

Title of the course : **Engineering Materials and Metallurgy Lab.**
Subject Code : **PCME209**
Weekly load : 2 LTP 0-0-2
Credits : 1

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Identify, inspect and become familiarized with various engineering materials

CO2: Learn about various metallurgical studies as well as various heat treatment processes applicable for different engineering materials

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	2	3	2	1	2	2	2
CO2	3	3	3	3	2	1	2	2	2
Avg.	3	3	2.5	3	2	1	2	2	2

List of experiments

1. Visual inspection and identification of various types of engineering materials.
2. To study BCC, FCC, and HCP crystals structures.
3. To study Iron carbon equilibrium diagram.
4. To carry out Specimen preparation procedures for metallographic studies of a ferrous and a non-ferrous specimen.
5. To reveal microstructure of a given specimen, view it and capture it using a metallurgical microscope and make interpretations about it.
6. To carry out microhardness test on a given specimen.
7. To study the working operation of a muffle furnace used for heat treatment of engineering materials.
8. To carry out different heat treatment operations on given specimens.
9. To carry out hardening operations on given specimens (like quenching, flame hardening etc.)
10. To make a comparative study on effect of annealing, normalizing, and hardening on microhardness of a given specimen.

Recommended Books:

1. Materials Science and Engineering AN INTRODUCTION WILLIAM D. CALLISTER, JR. and DAVID G. RETHWISCH. Publisher: Wiley.
2. Materials and Metallurgy by OP Khanna, Published by Dhanpat Rai.
3. Heat treatment principles and techniques by Rajan and Sharma, Published by PHI.
4. Introduction to Physical Metallurgy by Sidney H Avner, Published by TMH.

Title of the course	: **Thermal Engineering Lab**		
Subject Code	: **PCME211**		
Weekly Load	: 02	LTP	0-0-2
Credit	: 01		

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: To understand constructional details and operation of Boilers i.e. Babcock and Wilcox, Lancashire and locomotive boiler.

CO2: To understand constructional details and working of Boilers mountings and Accessories

CO3: To understand constructional details and operation of 2-stroke and 4-stroke engines.

CO4: Learn to find out the performance of engines (4-Stroke-Diesel engine).

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	3	3	2	1	2	3	1
CO2	3	2	2	3	3	1	1	2	1
CO3	2	2	3	3	3	2	2	2	1
CO4	3	2	3	2	3	1	1	3	2
Avg.	2.75	1.5	2.75	2.75	2.75	1.25	1.5	2.5	1.25

List of Experiments:

1. Construction Details and Operation of Babcock and Wilcox boiler.
2. Construction Details and Operation of Lanchashire boiler.
3. Construction Details and Operation of mounting and accessories of a boiler.
4. Construction Details and Operation of locomotive boiler.
5. Construction Details and Operation of 2-stroke petrol engine.
6. Construction Details and Operation of 4-stroke petrol engine.
7. Construction Details and Operation of 4-stroke diesel engine.
8. To find the performance parameters of a diesel engine (B.H.P, thermal efficiency, fuel consumption, air consumption.)
9. To find the performance parameters of a petrol engine (B.H.P, thermal efficiency, fuel consumption, air consumption.)

Title of the course : **Metrology & Mechanical Measurements Lab**
Subject Code : **PCME213**
Weekly load : 2 LTP 0-0-2
Credit : 1

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn fundamentals of measurement and working principles of measuring equipments.

CO2: Acquire necessary skills for operating different measuring equipments.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	3	1	2	2	3	3
CO2	3	3	3	3	1	2	2	3	3
Avg.	3	3	3	3	1	2	2	3	3

List of Experiments:

1. Study and measurement using surface plate, angle plate, V-block, try square, surface gauge, marking gauge, telescopic gauge, engineering scale.
2. Study and use of micrometer.
3. Study and use of vernier calliper.
4. Study and use of vernier height gauge.
5. Study and use of the bore gauge.
6. Study and uses of the dial indicator.
7. Finding out the angle of given job by using sine bar and slip gauge.
8. Finding out the angle of given job by using universal bevel protector.
9. Finding the angle of small object as well as linear measurement by using tool maker microscope.
10. Finding the angle of small object as well as linear measurement by using profile projector.
11. To check the surface roughness of given surface by using surface roughness testing machine.
12. To check circulation of given job by using V-block and dial indicator.

Title of the course : **Strength of Materials**
Subject Code : **PCME202**
Weekly load : 4 LTP 3-1-0
Credit : 4

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Understand the basic properties of Engineering Materials and their testing.
CO2: Identify and analyze the various stresses and deformations acting on engineering component
CO3: Solve complex Engineering problems by applying Concepts of various stresses on the component.
CO4: Understand and analyze the Springs Beams Columns and struts.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	3	2	1	1	2	3	1
CO2	3	3	2	3	1	1	1	2	1
CO3	2	1	3	1	1	1	2	2	1
CO4	3	2	3	2	1	1	1	3	2
Avg.	2.75	1.5	1.75	1.75	1	1	1.25	2.75	1.25

Course Description	**Lecture(s)**
Unit-I	
Stress and Strain & Properties of Materials	
Mechanical properties of materials Ductility, Tenacity, Brittleness, Toughness, Hardness, Factor of safety. Different types of loads and stresses, Normal stress and strain, shear stress and strain, concept of bearing stress, strain in a stepped bar. Hooke's law and Poisson's ratio, Modulus of elasticity in tension, compression, shear. Bulk modulus. Stress-strain diagrams for ductile and brittle materials, Extension of axial loaded members: uniform bars, Extension due to self-weight, Composites section, Concept of temperature stress, relation between elastic constant E, G, and K, Concept of strain energy	**06**
Principal Stresses	
Stresses in two perpendicular planes. Determination of normal and shear stress components on any plane passing through a point. Concept of principal stresses and principal planes and their importance. Derivation of equations for principal stresses and determination of normal and shear stress components on a plane with Mohr's Circle construction. Concept of pure shear and complementary shear.	**08**
Bending Moment and Shear force	
Types of beams, Loads and reactions, Concept of Bending moment and shear force, bending moment and shear force diagrams for determinate beams and different loads, Concept of point of Contraflexure, Relation between loads, shear forces and bending moments. Loading and bending moment diagrams from shear force diagrams. (Simple cases)	**08**
Bending Stresses in Beams	
Concept of pure bending, derivation of straight beam formula, section modulus, determination of bending stresses under different loads for different section of beams, Shear stress.	**08**
Unit-II	
Torsion	
Torsion of circular straight shafts, (Solid & hollow), derivation of torsion equation, Power transmitted by solid and hollow shaft, comparison of solid and hollow shaft	**06**
Springs	
Helical springs, Close coiled helical spring subjected with axial load and axial twist, Determination of spring stiffness for series and parallel combinations.	**06**

Columns and Struts	
Definition of long column, short column and slenderness ratio. Equivalent length, Critical load, Collapsing load, End conditions of columns. Euler's theory for long columns and its limitations, Euler's formula and Rankine Gordon formula for different end conditions (No Derivation) Slenderness ratio, factors effecting strength of a column,	06

Total=48

Recommended Books:

Strength of Materials	R.K. Rajput	S. Chand
Strength of Materials	Sadhu Singh	Khanna Publishers
Strength of Materials	R.S Kurmi	S. Chand
Mechanics of Materials	R.C. Hibbeler	Pearsons Education
Mechanics of Materials	Fardinard P. Beer and E. Russell Johnston	McGraw Hill

Title of the course	: **FLUID MECHANICS**		
Subject Code	: **PCME204**		
Weekly load	: 3	LTP	3-0-0
Credit	: 3		

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn fundamentals of fluid mechanics and properties in order analyse engineering problems.

CO2: Learn basics about fluid pressure and application of tools for measuring it.

CO3: Understand the behavior of flowing fluid along with the forces applied during its motion.

CO4: Analyse the impact of fluid jet on various type of plates and its application to hydraulic machines

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	2	1	1	3	3	1
CO2	3	2	2	3	1	1	3	3	1
CO3	3	3	3	2	2	1	3	3	1
CO4	3	3	3	3	2	1	3	3	3
Avg.	3.00	2.75	2.75	2.50	1.50	1.00	3.00	3.00	1.50

Course Description	**Lecture**
Unit I	
Fluid Mechanics & Fluid Properties	
Concept of fluid, fluid mechanics and hydraulics, properties of fluid i.e. viscosity, specific weight, specific volume, specific. Gravity and their measurement, surface tension, capillarity, vapour pressure	**06**
Static Pressure	
Pascal's law, concept of static pressure, intensity of pressure and pressure head, total Pressure on a plane surface and centre of pressure	**09**
Measurement of pressure	
Concept of atmospheric pressure, gauge pressure, absolute pressure, vacuum, Measurement of pressure, Gauges: Piezometer, simple manometer, differential manometer, U-tube manometer, inverted U-tube manometer, micro manometer and Bourdon pressure gauge.	**09**
Unit-II	
Flow of fluids	
Types of flow: steady/unsteady, uniform/non-uniform, laminar/turbulent, rotational/irrotational etc. rate of discharge, law of continuity and its application to pipes, explanation to streamlines, path lines, streak lines.	**06**
Fluid Dynamics	
Energy of fluid - potential, pressure and kinetic, Bernoulli's theorem and its applications, discharge measurement by venturimeter and orifices, pitot tube and pitot static tube.	**07**
Impact of jet	
Impact of jet, Impulse momentum principle, Force exerted on fixed and moving flat plate and curved vanes under different orientation of jet.	**07**
Introduction to application of Fluid Mechanics in Hydraulic Machines	
Working principles, description and application of hydraulic accumulator, hydraulic intensifier, hydraulic lift, hydraulic jack, hydraulic ram, hydraulic press, hydraulic crane.	**04**
	Total=48

Recommended Books:

Title	*Author(s)*	*Publisher*
Fluid Mechanics & Hydraulic Machines	R.K.Bansal	Laxmi Publications
Hydraulics & Fluid Mechanics Hydraulic Machines	Modi & Seth	Standard Publishers
Fluid Mechanics & Hydraulic Machines	R.K Rajput	S.Chand & Company
Fluid Mechanics & Fluid Machinery	D. S. Kumar	S.K Kataria & Sons
Theory & problems of Fluid Mechanics	K Subramanya	Tata McGrawHill

Title of the course: : **Tool Room Techniques - II**
Subject Code: : **PEME202 (A)**
Weekly load: : 3 LTP 3-0-0
Credit: : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Ability to understand the basic of plastic, rubber and machining.
CO2: Understand different machining, plastic operations.
CO3: Apply various processing and super finishing techniques
CO4: Students will understand the knowledge of non-conventional machining.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	1	1	1	1	1	2
CO2	1	3	1	1	1	1	1	2	2
CO3	2	1	1	1	1	1	1	2	1
CO4	2	3	1	1	1	1	1	3	2
Avg.	2	2.25	1	1	1	1	1	2	1.75

Course Description	**Lecture(s)**
Unit-I	
Processing of Plastics	10 Hrs
Introduction to plastic material: Types of plastics, differentiation of plastics, Properties, application, fillers and additives and reinforced plastics. Mould terminology: Core, cavity, impression, runner, gate, sprue bush, mould base etc. Parting line: Types of parting line, mould matching (Bedding down), vent and relief.	
Tool & Die Maker	10 Hrs
(Dies &Moulds) Requirement for ejection: Types of ejector grids, ejector elements and ejector system. Feed System: Sprue, runner, gate, types, design and calculations, vent design, balancing, etc:	
Introduction to rubber materials, rubber molding processes, applications of rubber products.	4 Hrs
Unit-II	
Machining processes	10 Hrs
Different types of Lathe operations - facing, turning, parting-off, grooving, chamfering, boring etc. Jig boring machine, jig grinding, sawing machine, working principle, types of tools used, job setting & accessories for these machines, super finishing processes.	
Basic concepts of New manufacturing processes	14 Hrs
Electrical discharge machine (EDM) introduction principle of operation, advantages and disadvantages and its applications. Introduction principle of operation advantaged and disadvantaged and applications, Electrochemical machining (ECM), principle, working & construction of ECM. Introduction principle of operation advantaged and disadvantaged and applications	
	Total=48

Recommended Books:

1. Production technology R.K. Jain Khanna
2. Tool engineering & Design G. R. Nagpal Khanna
3. Manufacturing processes Begeman John Wiley
4. Production Engineering Pandey & Singh S. Chand

Title of the course	: **Foundry Technology-II**		
Subject Code	: **PEME202 (B)**		
Weekly load	: 3	LTP	3-0-0
Credit	: 3		

COURSE OUTCOMES:

After successful completion of course, the students should be able to-

CO1: Learn the fundamentals of the design and design procedures of various moulding materials and assemblies and associated safety factors.

CO2: Study about melting and pouring of material in casting.

CO3: Analysis casting Defects and Inspection of castings.

CO4: Design considerations of Casting.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	2	1	1	1	1	2	1	1
CO2	1	2	2	2	1	2	1	2	2
CO3	1	2	2	1	1	1	2	2	1
CO4	1	2	3	2	1	1	2	2	1
Avg.	1.25	2	2	1.5	1	1.25	1.75	1.75	1.25

Course Description	**Lecture(s)**
Unit-I	
Introduction	**06**
Review of moulding materials and assemblies, core making, gating and rising of castings.	
Melting and pouring	
Classification of melting furnaces, handling of molten metal and metal pouring, uses of fluxes.	**06**
Cleaning of castings	**06**
Shake out, cleaning of sand from casting, shot blasting, burnishing, trimming of gates and risers, controls of fins.	
Special casting techniques	**06**
Die casting, shell moulding, centrifugal casting, investment casting, slush casting, continuous casting, vacuum casting and vibration casting.	
UNIT-II	
Solidification and casting Defects	**06**
Directional solidification, Chills, padding and exothermic compounds. Various casting defects, causes and their remedies.	
Inspection of castings	**06**
Visual inspection, dimensional inspection, non-destructive testing, pressure testing, radiographic inspection, inspection and repair of cracks by use of fillers and welding.	
Casting design considerations	**06**
Function design-mechanical strength, columnar solidification. Dimensional design factors-minimum section thickness, surface finish, flanges, ribs and junctions.	
Mechanization of moulding processes	**06**
Squeezer, jolt machines, jot squeeze machine, slingers, blowers.	
	Total=48

Recommended Books:

1. Principle of foundry technology by PL Jain, Khanna Publishers.
2. Foundry Technology by O P Khanna, Dhanpat rai.
3. Foundry Technology by Srinivasan, Khanna Publishers.
4. Principles of metal casting, Richard W Heine, By TMH Publishers.

Title of the course : **Inspection and Testing of Weldments**
Subject Code : **PEME202 (C)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to;

CO1: Understand, interpretation and application of welding symbols.
CO2: Identification of welding defects, their causes and suggest remedial actions.
CO3: Prepare WPS, POR for a given welding Job.
CO4: Perform destructive and non-destructive tests.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	1	1	1	3	1	1
CO2	1	2	2	1	1	1	1	2	1
CO3	1	2	3	2	1	1	1	2	1
CO4	1	3	3	2	1	1	3	3	2
Avg.	1.5	2	2.25	1.5	1	1	2	2	1.25

Course Description	**Lecture(s)**
Unit-I	
Welding Symbols	**06**
Basic welding symbols, supplementary symbols, Examples and applications, location of weld symbols on drawing as per BIS codes	
Weld Related Discontinuities	**10**
Definition of discontinuity, imperfection and defects, classification of various welding defects, causes and remedies.	
Welding Procedure Specifications	**08**
Meaning of welding inspection, responsibilities in welding inspection, role and certification of welding inspectors. Description and important details of WPS; Essential, non-essential and supplementary variables, various steps in procedure qualification, PQR (procedure qualification record).	
UNIT-II	
Qualification of Welders and Welding Operators	**06**
Welding performance qualification-requirement, qualification and re-qualification of welders, Qualification record, Essential and non-essential variables in performance qualification.	
Destructive Testing of Welds	**09**
Classification and description of destructive testing techniques like Tensile test, Bend test, Impact test, Hardness test, Fatigue test.	
Non-Destructive Testing of Welds	**09**
Visual inspection, dye-penetrate inspection, magnetic particle inspection, ultrasonic testing, radiographic testing, eddy current testing.	

Total=48

Recommended Books

Title	***Author(s)***	***Publisher***
Welding Engineering & Technology	R. S. Parmar	Khanna Publications
Modern Arc Welding Technology	S. V. Nadkarni	Oxford & IBH.
AWS Welding Handbook, Volume-1	Leonard. P. Connor	AWS
Statistical Quality Control	Juran	McGraw Hill.
Quality Control	Mahajan	Dhanpat Rai & Sons
Method of Testing Fusion Welded Joints and Weld Metals in Steel	IS-3600 (Part-I & II)	BIS, New Delhi
ASME Boiler and Pressure Vessel Code Section IX.		ASME
Welding Technology	O P Khanna	Dhanpat Rai

Title of the course : **Advanced Agricultural Equipments**
Subject Code : **PEME202 (D)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn the process of planting various crops with the help of specific equipments.

CO2: Understand the process of harvesting/threshing of various crops with associated equipments along with crop post processing.

CO3: Learn the various parts of tractor and its maintenance.

CO4: Understand the science behind protection of crop from insects and diseases by using suitable equipments.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	3	2	2	3	3	2
CO2	3	2	3	3	3	2	3	3	2
CO3	2	3	2	3	2	2	2	2	3
CO4	2	2	3	2	3	2	3	2	2

Course Description	**Lecture(s)**
Unit-I	
Planting Equipment	
Introduction, types, working, construction, material adjustment, operation, maintenance, specifications of: Potato planters (semi auto and automatic), Sugarcane planter, Multi-crop planter, Paddy trans-planter. Safety precautions in handling these equipment's.	8
Harvesting / Threshing equipment:	
Introduction, types, working, construction, material adjustment, operation, maintenance, repair & specifications of Reaper, Wheat Thresher, Groundnut decorticator and Harvesting Combine: Self operated combine & tractor operated.	8
Processing equipment	
Introduction, type, working, construction, material adjustment, and operation, specification of: Chaff cutter, Sugarcane crusher and rice huller.	8
Unit-II	
Tractor and Automotive Engines	
Development of the tractors and functions of farm tractor, introduction to special feature of tractors such as: Body cooling system, steering system, transmission, final drive, clutch, PTO, hydraulic system, brake, hitching system, starting and operation of tractor, repair, maintenance, common defects, few causes and their remedial measures. Driving practice in the field.	14
Plant Protection Equipment's	
Introduction, types, working principle, construction, mode of operation of sprayer and duster: hand operated, power operated, hydraulic tractor drawn.	10
	Total= 48

Recommended Books:

Title	Author(s)	Publisher
Principles of Farm Machinery	Kepner	C. B. S
Farm Power Machinery & Surveying	Irshad Ali	Kitab Mahal
Farm mechanism & Farm Machinery & Power	O.P. Singhal	Orient Offset Printers
Elements of Agricultural Engineering	Jagdishwar Sahay	Standard publishers distributors

Title of the course : **Refrigeration and Air Conditioning-II**
Subject Code : **PEME202 (E)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, Student able to learn following

CO1: Understand importance of temperature and humidity in food preservation and storage.

CO2: Design HVAC systems for diverse residential and commercial applications.

CO3: Evaluate and install portable air conditioning units in various transportation settings.

CO4: Analyze non-comfort air conditioning requirements in industrial and healthcare facilities.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	POS1	POS2
CO1	3	2	2	2	2	2	2	2	2
CO2	1	3	2	2	3	2	3	2	2
CO3	2	2	2	2	2	2	2	3	3
CO4	2	2	3	3	2	2	3	2	3
Avg.	2	2.25	2.25	2.25	2.25	2	2.5	2.25	2.5

Course Description	**Lectures**
Unit-I	
Refrigeration	
Importance of temperature and humidity control in food preservation, Equipment used for food preservation. Domestic Applications: Specifications and features of various refrigerators. Commercial Applications: Introduction and application of deep freezers, and ice cube machines. Applications in pharmaceutical storage, and temperature-controlled logistics (cold chain). Role of Bureau of Energy Efficiency in India.	**10**
Comfort Air Conditioning	
Human thermal comfort: parameters and standards, Design of HVAC systems for residential and commercial buildings. Working and usages of Desert Cooler, Window Air Conditioner, Split Air Conditioner, Package Air Conditioner, and Central Air Conditioning plant.	**10**
	10
Unit-2	
Portable Air Conditioning	
Design and functionality of portable air conditioning units: Car air conditioner, Bus air conditioner, and Train air conditioner.	**8**
Installation of Air Conditioners	
Factors influencing A/C type selection (room size, usage, etc.), Methods for determining cooling capacity (BTU, tonnage), Sizing A/C units for different room configurations. Installation procedures and requirements, Slope considerations for window and split A/Cs, Sealing and insulation around window units, Criteria for outdoor unit placement (airflow, noise, accessibility), Designing efficient and practical piping routes, Materials and insulations for piping, Minimizing bends and joints for efficiency, Safety considerations during installation.	**12**
Non-Comfort Air Conditioning	
Role of air conditioning in manufacturing, industrial processes, hospitals, laboratories, and data centers. Case studies and performance analysis.	**8**
	Total-48

Recommended Books

Title	*Author(s)*	*Publisher*
Refrigeration and Air conditioning	C. P. Arora	TMH
Refrigeration and Air conditioning	Domkondwar	Khanna
Refrigeration and Air conditioning	Balleney	Khanna
Ref and Air Conditioning	Gupta & Prakash	New Chand

Title of the course : **FUNDAMENTAL OF TOOL AND DIE DESIGN**
Subject Code : **PEME204 (A)**
Weekly load : 4 LTP 3-1-0
Credit : 4

COURSE OUTCOMES:
After successful completion of course, the students should be able to-
CO1: Understand the basic principle of the tool design, Jigs and Fixtures
CO2: Analyse the basic design of forging dies and mold.
CO3: Analyse casting dies design, Defects and Inspection of castings.
CO4: Understand the basic considerations of Tool automats.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	2	1	1	1	1	2	1	1
CO2	1	2	2	2	1	2	1	2	2
CO3	1	2	2	1	1	1	2	2	1
CO4	2	2	3	2	1	1	2	2	1
Avg.	1.5	2	2	1.5	1	1.25	1.75	1.75	1.25

UNIT-1	Hrs
Cutting Tool Design: Fundamentals of Cutting tools design, cutting tools and their principal elements, Tool geometry, system of nomenclatures and their interrelations, setting for the grinding of various basic cutting tool (turning, drilling, milling)	6 Hrs
Analyses and Design of Jigs and Fixture: Principles of jig and fixture design, Dual cylinder location, diamond pin analysis, V-block analysis, design principles of centralisers, various mechanisms and design of equalizers, analysis for optimum number of clamping forces required and calculation of their magnitudes, concept of modular fixtures, design of fixtures for NC/CNC machines, computer applications in fixture design and analysis.	6 Hrs
Design of press tools: Components of die design, design of die blocks, punches and strippers, methods of holding punches, sketches of stock stops, Design procedure for progressive dies, compound dies and combination dies for press tool operation forging die design for drop and machine forging parts. Computer applications in press tool design.	6 Hrs
UNIT-II	
Design of forging dies: Grain flow considerations, parting line selection, draft, design problems involving ribs, bosses and fillets. Flash and flash control, determination of number of impressions required and their sequence, design steps and analysis of forging dies, detail calculations, shrinkage, cavity shapes, heat transfer considerations, cooling and ejection systems, automation in forging operations, computer aided design and analysis.	6 Hrs
Design of injection molds: Principles of melt processing, product considerations, determination of economical number of cavities, temperature control of injection molds, calculation of mold opening force and ejection force. Detail design of cooling system, ejection system and gating system. Moldability features, mold flow analysis.	6 Hrs
Die casting die design: Metals for die casting, specific details of die construction, casting ejectors, side cores, loose die pieces, slides, types of cores, directional solidification, types of feeders, die venting, water cooling, design aspects of die casting dies, defects.	6 Hrs
Tooling for Automats: Cam design for automats, gauge design – gauge allowances and tolerance – Materials for gauges. Economics of Tooling: Selection of economical method – amortization of tooling costs.	6 Hrs
Total	48 Hrs

Recommended Books:

1. Workshop Technology(Vol-1) Chapman CBS
2. Production Technology R. K. Jain Khanna
3. Jigs & Fixtures Gant TMH
4. Workshop Technology Vol.I & II Hajra Choudhary Media Promoters
5. Workshop Technology Vol.I & II B. S. Raghuvanshi Dhanpat Rai

Title of the course : **Forging Technology**
Subject Code : **PEME204 (B)**
Weekly load : 4 LTP 3-1-0
Credit : 4

COURSE OUTCOMES:
After successful completion of course, the students should know
CO1: The fundamentals of forging and equipment associated with it.
CO2: Perform different forging operations and follow safety guidelines.
CO3: Study and analyse forging defects.
CO4: Inspection of forging defects and ways to overcome them.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	2	1	1	1	2	1
CO2	2	2	2	3	1	2	2	3	2
CO3	3	3	1	2	1	1	2	2	1
CO4	1	3	3	2	1	2	2	2	2
Avg.	2.25	2.25	1.75	2.25	1	1.5	1.75	2.25	1.5

Course Description	**Lecture(s)**
Unit-I	
Introduction	**04**
Various forging processes and their limitations, characteristics of forged components, concept of flow lines, computation of stroke size, weight and loss, role of yield and economics, safety requirements in forging.	
Hand and close die forging	**07**
Bending, cold and hot forging, role of heat and energy, hand forging equipment, heating, effect of heat in hand forging process. Hand forging applications. Components and construction of closed die forging, advantages and disadvantages of closed die forging, type of loading, hammer and press forging.	
Forging processes and equipment	**05**
Drop forging, mechanism of loading; (mechanical, hydraulic, pneumatic forgings hammers). Press forging, forging die, concept of constancy of volume, shape, role of flash gutter. Special forging processes (roll forging, swaging, and roll forming).	
UNIT-II	
Forging operations	**08**
Various forging operations (forging, forge welding, punching, shearing, fullering, drawing, upsetting, blocking, bending and trimming). Forging die materials and properties, type of joints and dies, past forging operations (coining, straightening, repair and stress relieving etc.)	
Forging defects and losses	**04**
Mismatch, cracking, fire cracks, scaling and oxidation, hand care, tongue mark, scale loss, shear waste	
Forging inspection	
Visual inspection, magna flux and ultrasonic testing, real time radiography.	**04**
	Total=32

Recommended Books:

1. Workshop Technology-I, by B S Raghuwanshi, Publisher Dhanpat Rai.
2. Workshop Technology-I, by Hazara chaudhary, Publisher Media Promoters.
3. Manufacturing Technology, by Kalpat Jain, Publisher TMH.
4. Metal Forming, by Nagpal, Publisher Khanna

Title of the course	: **WELDING TECHNOLOGY II**		
Subject Code	: **PEME204 (C)**		
Weekly load	: 4	LTP	3-1-0
Credit	: 4		

COURSE OUTCOMES:

After successful completion of course, the students should be able to;

CO1: Learn fundamentals of advanced welding processes.

CO2: Identify and select a suitable welding process for a particular application.

CO3: Identify and select suitable welding parameters.

CO4: Apply safety measures during welding operations.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	1	1	1	3	1	1
CO2	1	2	2	1	1	1	1	2	1
CO3	1	2	3	2	1	1	1	2	1
CO4	1	3	3	2	1	1	3	3	2
Avg.	1.5	2	2.25	1.5	1	1	2	2	1.25

Course Description	**Lecture(s)**
Unit-I	
Gas Tungsten Arc Welding	
Introduction of the process, basic principle of operation, consumables for the process, equipment study and the working procedure of the equipment, electrodes used for GTAW process, variants of the process, application and scope of the GTAW process.	08
Plasma Arc Welding	
Principle of plasma arc welding, difference between transferred and non transferred arc, comparison of plasma arc welding with GTAW process, application and scope of the plasma arc welding.	08
Gas Metal Arc Welding	
Introduction of the process, basic principle of operation, consumables for the process, equipment study and the working procedure of the equipment, selection of shielding gases for various materials, edge preparations, metal transfer in GMAW process, working parameters for dip, globular and spray modes of metal transfer, variants of the GMAW process, application and scope of the process.	08
Unit-II	
Submerged Arc Welding	
Power sources used for SAW, principle of the submerged arc welding, electrode wires used in SAW, types of fluxes and their respective applications, edge preparations and the welded joints, scope and application of the process.	10
Electro Slag Welding & Electro gas Welding	
Introduction of the electro slag and electro gas welding process, difference between the two, study of the equipment and working procedure for the electro slag and electro gas welding processes, applications and scope.	10
Welding of Plastics	
Types of plastics, use of plastic in the fabrication industry, introduction to various techniques used for welding the plastics.	04
	Total=48

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Recommended Books:

Title	*Author(s)*	*Publisher*
	Text	
Welding processes & technology	RS PARMAR	Khanna Publishers
	Reference	
Principles of welding technology	LM GOURD	Edward Arnol
Welding technology	OP KHANNA	Dhanpat Rai
Modern arc welding	SV NADKARNI	Oxford & IBH

Title of the course : **Farm Machinery-II**

Subject Code : **PEME204 (D)**

Weekly load : 4 LTP 3-1-0

Credit : 4

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn the process of planting various crops with the help of specific equipments.

CO2: Understand the process of harvesting/threshing of various crops with associated equipments along with crop post processing.

CO3: Learn the various parts of tractor and its maintenance.

CO4: Understand the science behind protection of crop from insects and diseases by using suitable equipments.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	3	2	2	3	3	2
CO2	3	2	3	3	3	2	3	3	2
CO3	2	3	2	3	2	2	2	2	3
CO4	2	2	3	2	3	2	3	2	2

Course Description	**Lecture(s)**
Unit-I	
Planting Equipment	
Introduction, types, working, construction, material adjustment, operation, maintenance, specifications of: Potato planters (semi auto and automatic), Sugarcane planter, Multi-crop planter, Paddy trans-planter. Safety precautions in handling these equipment's.	8
Harvesting / Threshing equipment:	
Introduction, types, working, construction, material adjustment, operation, maintenance, repair & specifications of Reaper, Wheat Thresher, Groundnut decorticator and Harvesting Combine: Self operated combine & tractor operated.	8
Processing equipment	
Introduction, type, working, construction, material adjustment, and operation, specification of: Chaff cutter, Sugarcane crusher and rice huller.	8
Unit-II	
Tractor and Automotive Engines	
Development of the tractors and functions of farm tractor, introduction to special feature of tractors such as: Body cooling system, steering system, transmission, final drive, clutch, PTO, hydraulic system, brake, hitching system, starting and operation of tractor, repair, maintenance, common defects, few causes and their remedial measures. Driving practice in the field.	14
Plant Protection Equipment's	
Introduction, types, working principle, construction, mode of operation of sprayer and duster: hand operated, power operated, hydraulic tractor drawn.	10
	Total= 48

Recommended Books:

Title	Author(s)	Publisher
Principles of Farm Machinery	Kepner	C. B. S
Farm Power Machinery & Surveying	Irshad Ali	Kitab Mahal
Farm mechanism & Farm Machinery & Power	O.P. Singhal	Orient Offset Printers
Elements of Agricultural Engineering	Jagdishwar Sahay	Standard publishers distributors

Title of the course	: **Fundamental of Heat and Mass Transfer**		
Subject Code	: **PEME204 (E)**		
Weekly load	: 4	LTP	3-1-0
Credit	: 4		

COURSE OUTCOMES:

After successful completion, of the course, students should be able to

CO1: Understand fundamentals of different types of modes of Heat transfer.

CO2: Develop skills for solving various heat transfer problems.

CO3: To understand the concept of fin, its application & Heat exchangers and develop skills in design

CO4: Understanding the concept of radiation bodies and their exchange of energies and Mass-Transfer concept

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	2	2	2	2	2	2	2
CO2	3	3	2	2	3	2	3	2	3
CO3	2	2	3	3	2	2	3	3	2
CO4	2	2	1	1	2	2	2	2	2
Avg.	2.5	2	2	2	2.25	2	2.5	2.25	2.25

Course Description	**Lecture(s)**
Unit-I	
Introduction	
Different modes of heat transfer: conduction, convection, radiation.	4
Conduction	
Fourier's law of heat conduction, thermal Conductivity, effect of temperature and pressure on thermal conductivity of solid, liquid. Electrical analogy for solving 1-D steady state conduction problem for slab, cylinder, sphere and influence of variable thermal Conductivity.	4 4
Application of conduction	
Straight fins of rectangular cross-section, efficiency of fin, fin effectiveness for rectangular and circular cross section fins. Critical radius of insulation for pipes and electrical cables.	6
Convection	
Free and forced convection, Concept of Dimensional analysis for forced and free convection	4
Unit-2	
Boiling and Condensation	
Introduction, boiling phenomena, pool boiling regimes, condensation drop-wise and film-wise.	4
Heat Exchangers	
Overall coefficient of heat transfer, different design criterion of heat exchangers (LMTD method), calculation of number, diameter & length of tubes, mean temperature difference for parallel & counter flow heat exchangers.	8
Radiation	
Laws of radiation, definition of- emissivity, absorptivity, reflectivity and transmissivity. Concept of black and grey bodies Planck's law monochromatic radiation, Kirchoff's law and the geometric factor. Lambert's cosine law, definition of intensity of radiation, radiation exchange between simple bodies.	8

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Mass Transfer	
Mass transfer process: classification, Concentrations, velocities and fluxes, Fick's law, Steady state diffusion through a plain membrane.	6

Total-48

Recommended Books:

Title	*Author(s)*	*Publisher*
Heat and Mass Transfer	R. K. Rajput	S. Chand
Heat Transfer	J.P. Holman	TMH
Heat and Mass Transfer	R.C. Sachdeva	New Age International
Heat and Mass Transfer	R. Yadav	Central Publishing House
Heat Transfer	P.K.Nag	TMH
Heat Transfer	Domkundwar	Dhanpat Rai

Title of the Course : **Industrial Engineering**
Subject Code : **OEME202 (A)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to-

CO1: Understand the concept of industrial engineering, production, productivity, work method design and ergonomics in various industries.

CO2: Apply principles of method study and time study for design of work systems

CO3: Apply the concept of inventory control and understanding of material handling equipment used in industries

CO4: Understanding the concept of plant location and layout, plant maintenance and various types of industrial pollution and its control.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	1	2	1	2	2	3	2	3
CO2	1	2	2	3	1	3	1	2	2
CO3	3	3	2	2	2	3	1	3	2
CO4	1	1	2	1	3	2	3	3	3
Avg.	1.75	1.75	2	1.75	2	2.5	2	2.5	2.5

Course Description	**Lecture(s)**
Unit-I	
Introduction	**08**
Definition, applications, history and development, techniques of Industrial Engineering. Production and productivity, its importance, kinds of productivity measures, waste management, work method design, ergonomics.	
Work Study (Method Study)	**08**
Definition and scope of work study, role of work study in improving productivity, Objectives and procedure for method study, Process Chart symbols, Flow process chart, flow diagram, string diagram, Multiple activity chart.	
Work Study (Time Study)	**08**
Human aspects of work study, Objectives and procedures to conduct work measurement, Principles to design work place layout, Therbligs, S. I. M. O. Chart, Calculation of normal time and standard time, cycle graph and Chrono-Cyclograph, Work Sampling.	
Unit-II	
Inventory Management and Material Handling	**08**
Inventory Management: Introduction, costs associated with inventory, classifications of inventory, economic order quantity, deterministic inventory models, Inventory Control ABC analysis, and VED analysis. **Material Handling**: Functions and principles of material handling, Selection of material handling equipment, types and maintenance of material handling equipment.	
Plant Location and Layout	**08**
Introduction, Need for selecting a suitable location, Plant location problem, Importance and system view of location, Location factors, Comparison between Urban, Suburban and rural locations, Factors effecting plant location, Concept of plant layout, types of layout: process, product & combination, Flow pattern, Work station design, Storage space requirements, Plant Layout procedure.	
Plant maintenance and Environment Pollution	**08**
Plant maintenance: Objective and importance of plant maintenance, Types of plant maintenance, Plant maintenance schedule. **Environment Pollution:** Factors causing the pollution, effects, air-pollution and control, solid waste management, water pollution and control, noise and its control.	

Total = 48

Recommended Books:

Title	Author(s)	Publisher
	Text	
Industrial engineering	S. K Sharma	Kataria
Industrial Engineering and Production Management	Martand Telsang	S Chand
Industrial Engineering	Ravi Shankar	Galgotia
Industrial Engineering & Management	O.P.Khanna	Dhanpat Rai

Title of the course	: **Fundamentals of Manufacturing**	
Subject Code	: **OEME202 (B)**	
Weekly load	: 3	LTP 3-0-0
Credit	: 3	

COURSE OUTCOMES:

After successful completion, of the course, students should be able to

CO1: Analyze and access the use of casting processes in manufacturing and understand the working of various casting processes

CO2: Understand the basics of metal cutting and working of different types of machine tools.

CO3: Explain the conventional and advanced metal forming processes and composite fabrication.

CO4: Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	1	1	1	1	1	2
CO2	1	3	1	1	1	1	1	2	2
CO3	2	1	1	1	1	1	1	2	1
CO4	2	3	1	1	1	1	1	3	2
Avg.	.2	2.25	1	1	1	1	1	2	1.75

UNIT I

Introduction to basic manufacturing processes and engineering materials, Casting terminologies, solidification, expendable mould casting processes, patterns and risers, investment casting and plaster mould castings, die casting, centrifugal casting.	8hrs
Introduction to metal cutting, machining processes and machine tools. Orthogonal machining, Cutting forces, shear plane angle, Ernst Merchant theory, mechanics of metal cutting. Tool life equation. Lathe parts and turning operations, Cutting tool nomenclature, tool materials, tool wear. Various machine tools and operations.	7hrs
Metal Forming: fundamentals of metal forming, independent and dependent variables, hot working and cold working, warm forming, rolling. Forging and various types of forging, extrusion and various types of extrusion.	9hrs

UNIT II

Introduction to various press work operations, press working dies, shearing load and press selection, spinning, High energy rate forming, explosive forming, Electromagnetic forming and its applications, Fabrication of composites.	12hrs
Welding: Introduction to welding, types of welding. Welding machines, Shielded Metal Arc Welding (SMAW) process, Gas Metal Arc Welding (GMAW) process, Gas Tungsten Arc Welding (GTAW) process, Shielded Arc welding (SAW) process, Resistance welding, Seam, Spot and Flash butt welding, Ultrasonic welding, Laser beam welding, Automation in welding and various defects.	12hrs

Text books:

- A. Ghosh and A.K. Malik, Manufacturing Science, Affiliated East Press, New-Delhi.

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Mass Transfer	
Mass transfer process: classification, Concentrations, velocities and fluxes, Fick's law, Steady state diffusion through a plain membrane.	6

Total-48

Recommended Books:

Title	*Author(s)*	*Publisher*
Heat and Mass Transfer	R. K. Rajput	S. Chand
Heat Transfer	J.P. Holman	TMH
Heat and Mass Transfer	R.C. Sachdeva	New Age International
Heat and Mass Transfer	R. Yadav	Central Publishing House
Heat Transfer	P.K.Nag	TMH
Heat Transfer	Domkundwar	Dhanpat Rai

Title of the course : **Production Management**
Subject Code : **OEME202 (C)**
Weekly load : 03
Credit : 03 LTP 3-0-0

COURSE OUTCOMES:

After successful completion, of the course, students should be able to

CO1: Understand the basic knowledge of different production systems and Quality Control.
CO2: Ability to understand material handling management.
CO3: Analyze the problems related to sales management and forecasting.
CO4: Ability to understand the different organization systems.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	1	1	1	1	1	2
CO2	1	3	1	1	1	1	1	2	2
CO3	2	1	1	1	1	1	1	2	1
CO4	2	3	1	1	1	1	1	3	2
Avg.	2	2.25	1	1	1	1	1	2	1.75

Course Description	**Lecture(s)**
Unit-I	
Quality Control	**12**
Introduction, statistical control of processes, control charts for variables X & R Charts, X & s Charts ,properties of control charts, control charts for attributes – p chart, np chart, 100p chart, c chart.	
Quality assurance and acceptance control	**08**
Objectives of acceptance control, hypothesis testing in acceptance control, lot-by-lot acceptance sampling by attributes, acceptance procedures based on AQL.	
Total Quality Management	**04**
Evolution of quality improvement techniques, ISO standards, TQM approach,	
Unit-II	
Sales Management and Forecasting	**10**
Introduction, types of forecasting, importance of demand planning, methods of sales forecasting, Qualitative and Quantitative methods of demand planning	
Materials Handling and management	**08**
Principles of material handling, material handling equipments, material requirement planning, objectives of materials management, purchasing, vendor selection, JIT in purchasing, supply chain management.	
Business Organization and forms of Ownership	**06**
Introduction, Organization structure, good organization design, types of organizations, sole proprietorship, partnership.	
	Total = 48

Recommended Books:

Title Author(s)	*Publisher*
Industrial Engineering Ravi Shankar	Galgotia
Industrial Engineering & Management	O.P.Khanna Khanna
Production Management Ronald Mayer	TMH
Industrial Engineering & Management	Telesang S.Chand

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Recommended Books:

Title	Author(s)	Publisher
	Text	
Industrial engineering	S. K Sharma	Kataria
Industrial Engineering and Production Management	Martand Telsang	S Chand
Industrial Engineering	Ravi Shankar	Galgotia
Industrial Engineering & Management	O.P.Khanna	Dhanpat Rai

Title of the course : **Material Management**
Subject Code : **OEME202 (D)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Demonstrate appropriate level of understanding on principles of material handling.

CO2: Choose appropriate material handling equipment.

CO3: Apply the policies of Inventory Management and Develop overall materials requirement.

CO4: Understand the importance of warehouse and supplier development in materials management.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	3	2	2	3	3	1
CO2	2	3	3	3	3	3	3	3	3
CO3	3	3	2	2	3	3	3	3	2
CO4	3	3	2	2	3	2	2	3	3
Avg.	2.75	3	2.5	2.5	2.75	2.5	2.75	3	2.25

Course Description	Lecture(s)
Unit-I	
Basics Principles and Practices	
Concept of Integrated Materials Management System; Importance and scope of Materials Management; Supply Chain Management; Make or buy decisions; Vendor Rating and Business Correspondence	08
Purchase Management	
Procurement Cycle; Ethical concepts in Purchase; Procurement on GeM; Lead time Analysis; Integrity Pact- Standard Operating Procedure; Competition Commission of India.	10
Tendering	
Scrutiny of indents; Preparation of tender documents; Evaluation of tenders, Award of orders etc.	06
Unit-II	
Legal aspects of purchasing	
Indian Contract Act; Sale of Goods Act; Indian Companies Act; GST Act; Arbitration & Conciliation Act.	08
Stores and Inventory Control Management	
Online Materials Management System; Standardization and Codification of items; Stores function, Types of Stores, Receipts, Inspection, Storage Procedure, Preservation Procedure, Safety and Security aspects, Issue System, Disposal of unserviceable scrap including survey off and disposal activity, store records, legal aspects of store keeping.	08
Material Handling	
Materials Handling Systems and Equipment, Economic aspects of Materials handling and Transportation, Comparative Transportation costs, Issues relating to selection of carriers.	08
	Total=48

Recommended Books:

1. Dutta A.K., Materials Management: Procedures, Text and cases, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Gopalakrishnan, P. and Sundareson, M., Materials Management: An Integrated Approach, Prentice Hall of India Pvt. Ltd., New Delhi.
3. Varma, M.M., Essentials of Storekeeping and Purchasing, Sultan Chand and Sons, New Delhi.

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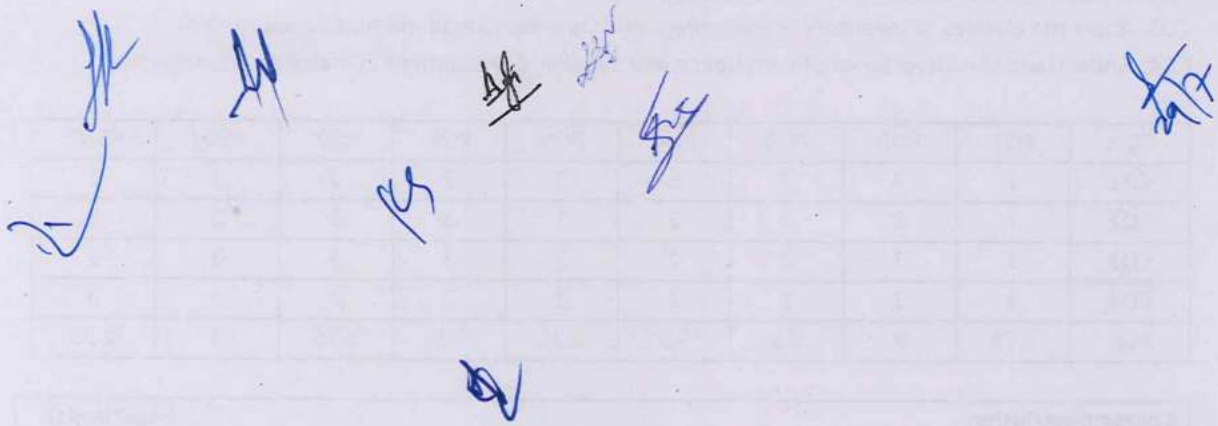
4. Shah N.M. An Integrated concept of Materials Management, Indian Institute of Materials Management, Baroda Branch, Baroda.
5. Sharma S.C., Material Management and Materials Handling, Khanna Publishers, New Delhi.
6. Arnold, Champman and Ramakrishnan, Introduction to Materials Management 5th ed., 2007 Pearson Education, Inc.
7. Pooler Victor H. Purchasing and Supply Management, Creating the Vision, New York, Chapman & Hall, 1997.
8. Moore, J.M., Plant layout and Design, Macmillan New York.



Title of the course : **Strength of Material Lab**
Subject Code : **PCME206**
Weekly load : 2 LTP 0-0-2
Credit : 1

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: To understand constructional details and operation of Universal Testing Machine.

CO2: To perform various test on Universal Testing Machine

CO3: To Understand Brinell Hardness test.

CO4: To Understand Impact and Torsion test.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	POS1	POS2
CO1	3	2	2	2	2	2	2	2	2
CO2	1	3	2	2	3	2	3	2	2
CO3	2	2	2	2	2	2	2	3	3
CO4	2	2	3	3	2	2	3	2	3
Avg.	2	2.25	2.25	2.25	2.25	2	2.5	2.25	2.5

List of Experiments:

1. Study and demonstration of Universal Testing Machine & its attachments.
2. Tension Test on mild steel, Aluminum & compression test on cast iron on Universal Testing Machine.
3. Study of Direct Shear Test of mild steel on Universal Testing Machine.
4. Study of Brinell hardness Test.
5. Study of Impact testing machine
6. Study of Torsion Testing Machine.

Title of the course	: **FLUID MECHANICS Lab**
Subject Code	: **PCME208**
Weekly load	: 2 LTP 0-0-2
Credit	: 1

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn practically about measurement of fluid properties and pressure.

CO2: Acquire necessary skill to use flow measuring instruments and hydraulic machines.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	3	2	2	3	3	2
CO2	3	3	3	3	2	2	3	3	3
Avg.	3	3	3	3	2	2	3	3	2.5

List of Experiments:

1. To determine Viscosity of a Liquid by Redwood viscometer.
2. To determine pressure difference using U-tube Manometer.
3. To determine pressure difference using Micro-manometer.
4. To Determine Pressure by Bourdon Tube Pressure Gauge.
5. To Verify Bernoulli's Theorem.
6. To determine Coefficient of Discharge of Venturimeter.
7. To determine Coefficient of Discharge of orifice meter.
8. To determine velocity of flow using Pitot Tube.
9. Demonstration of impact of jet in Pelton Turbine and evaluation its efficiency.
10. To find efficiency of a Hydraulic Ram.

Title of the course	: **Theory of Machines**		
Subject Code	: **PCME301**		
Weekly load	: 3	LTP	3-0-0
Credit	: 3		

Course Outcomes:

The theory, practical experiences and relevant soft skill associated with this course are to be taught and implemented, so that the student enables to achieve the following COs:

CO1: Identify the various links in popular mechanism and select suitable mechanism for various applications.

CO2: Interpret the motion of cam and followers. Select the suitable clutch for various applications.

CO3: Identify the need and recommend the relevant power transmission system.

CO4: Select suitable flywheel and governor for various application and understand the necessity of balancing of rotating machinery.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	2	2	3	3	2	2
CO2	3	3	3	2	2	3	3	3	2
CO3	3	3	3	2	2	3	3	3	2
CO4	3	3	3	2	2	3	3	3	2
Avg.	3	3	3	2	2	3	3	2.75	2

Course Description	**Lecture(s)**
Unit-I	
Basic Concept	**06**
Links, Kinematics pairs and their types, Degree of freedom, Kinematics chain and their types, Constrained motion and mechanisms, Classification of mechanisms, Equivalent mechanism, Laws of inversion of mechanisms, Four bar chain and its inversions, Single slider crank chain and its inversions, Quick return mechanism and IC engine mechanism, Double slider crank chain mechanism and its inversions like scotch yoke mechanism, Indicator mechanism, pantograph	
Velocity in mechanism	**06**
Concept of relative velocity and instantaneous center, Kennedy Theorem, Velocity diagrams of four bars and single slider crank mechanism using relative velocity method and instantaneous center method.	
Power Transmission	**08**
Introduction to Belt and Rope drives, Types of belt drives and types of pulleys, Concept of velocity ratio, slip and creep, crowning of pulleys. Flat belt drive: Ratio of driving tensions, power transmitted, centrifugal tension, and condition for maximum power transmission. Gear terminology, types of gears and their applications. Gear train; simple and compound gear trains; power transmitted by simple spur gear.	
Cams	**04**
Classification, types of motion curves, graphical construction of cam profiles for different motion with knife edge and roller followers.	
Unit-II	
Dynamics of reciprocating parts	**06**
Analytical method for velocity and acceleration of piston, piston effort, crank pin effort, turning moment diagram, fluctuation of energy and speed, energy of a flywheel, application of flywheel in punching press.	
Friction	**06**
Friction of collars and pivots, friction clutches; single plate clutch, multi-plate clutch, conical clutch and Centrifugal clutch.	

Governors	**06**
Types of governors-dead weight; watt, porter governor and Proell Governors, spring loaded governors; Hartnell governor, Hartung governor, Wilson-Hartnell Governor, concept of sensitiveness, stability, isochronous, and hunting.	
Balancing	**06**
Static and dynamic balancing. balancing of single rotating mass by a single mass in the same plane, by two masses rotating in different planes, balancing of several masses rotating in the same plane, balancing of several masses rotating in different parallel planes.	
	Total=48

Recommended Books:

Title	Author(s)	Publisher
Theory of Machines	Rattan S.S.	TMH, New Delhi, 2010
Theory of Machines and Mechanism	Ballaney P.L.	Khanna Publisher, New Delhi 2003
A Textbook of Theory of Machines	Bansal R.K. and Brar J.S.	Laxmi Publication, New Delhi 2004
The Theory of Machines	Beven Thomas	3rd Ed., Pearson Education India, New Delhi 2010
Theory of Machines and Mechanisms	Vicker, J.J., Shigley, J.E and Pennock, G.R.	3rd Ed., Oxford University Press, 2003

Title of the course : **Industrial Automation and Control**
Subject Code : **PCME303**
Weekly load : 2 LTP 2-0-0
Credit : 2

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn fundamentals of digital electronics and robotics

CO2: Learn basics of Pneumatics

CO3: Know the fundamentals of computer process monitoring and control

CO4: Develop ability for design and evaluation of material handling systems

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	2	1	1	2	3	1
CO2	3	2	2	2	1	1	1	3	1
CO3	2	1	1	1	1	1	1	2	1
CO4	3	2	3	2	1	1	1	3	2
Avg.	2.75	1.5	1.75	1.75	1	1	1.25	2.75	1.25

Course Description	**Lecture(s)**
Unit-I	
Introduction	
Definition, need of Automation, Automation strategies, advantages of automation	**02**
Fundamentals of Digital Electronics	
Number systems: Binary, Octal, Hexadecimal, Boolean Algebra, Logic Gates: Basic Gates and Derived Gates	**06**
Fundamentals of Robotics	
Definition, Link, Joint, Work space, Fine Motion, Gross Motion, Degrees of Freedom Basic configurations, End-effectors, applications, Introduction to position and force control	**07**
Sensors	
Strain Gauge, Linear variable differential transformer(LVDT), Piezoelectric, Proximity sensor, Resistance Temperature Detector(RTD), Thermistors, Thermocouple, Hall effect sensor	**03**
Unit-II	
Pneumatics	
Pneumatic power supplies, Components of basic Pneumatic system, selection of pipeline , Direction control valves: Types, Nomenclature, actuation systems, Pressure control valves: Pressure limiting, pressure relief and pressure sequence valves, Speed control valves, Check valves, Air Compressor, Types of Air Compressors, FRL unit Time delay valves, shuttle valve, Pilot operation	**09**
Computer based process control	
Characteristics of manufacturing process data, process data input/output, interface hardware, computer process monitoring, types of computer process control, Direct Digital control, supervisory computer control	**03**
Conveyor System	
Components of conveyor systems, types of conveyor systems, quantitative relationship and analysis of conveyor systems	**02**
	Total=32

Recommended Books:

1. W. Bolten, Mechatronics, Pearson Education
2. Andrew Parr, Pneumatic Systems, TMH
3. A.P. Malvino, Digital Principles and Applications, McGraw Hill

Title of the course : **Industrial Engineering & Management**
Subject Code : **PEME301**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Define the concept of productivity, waste management and ergonomics

CO2: Understand and apply the knowledge of work-study and allowances in work management

CO3: Calculate apply various inventory models and apply the knowledge of plant layout

CO4: Apply the concepts of management

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	1	1	1	2	3	1
CO2	3	3	2	2	1	1	1	3	1
CO3	2	3	2	3	1	1	1	2	1
CO4	3	2	2	2	1	1	1	3	2
Avg.	2.75	2.5	1.75	1.75	1	1	1.25	2.75	1.25

Course Description	**Lecture(s)**
Unit-I	
Introduction	8
Definition, applications, history and development, techniques of Industrial Engineering. Production and productivity, its importance, waste management, work method design, ergonomics.	
Work Study	10
Definition and scope of work study, role of work study in improving productivity, Objectives and procedure for method study, human aspects of work study. Objectives and procedures to conduct work measurement. Principles to design work place layout. Calculation of normal time and standard time, cycle graph and Chrono-Cyclograph.	
Unit-II	
Inventory control and material handling	8
Introduction, types, inventory models, economic order quantity. Functions and principles of material handling, types and maintenance of material handling equipment.	
Plant location and layout	10
Introduction, Need for selecting a suitable location, Plant location problem, Importance and system view of location, Location factors, Comparison between Urban, Suburban and rural locations, Factors effecting plant location, Concept of plant layout, types of layout: process, product & combination.	
Concepts of Management	6
Concept of Management and organization - functions of management, Organizational Structure – Departmentation – Line and Staff Structure, organization design	
	Total=42

Recommended Books:

Title	**Author(s)**	**Publisher**
Industrial engineering	S. K Sharma	Kataria
Industrial Engineering and Production Management	Martand Telsang	S Chand
Industrial Engineering	Ravi Shankar	Galgotia
Industrial Engineering & Management	O.P.Khanna	Khanna

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Reference books:	• Campbell, J.S., Principles of Manufacturing Materials and Processes, McGraw-Hill, New-York, • Rao, P.N., Manufacturing Technology, Volume 2, McGraw-Hill Education, New Delhi. • De Garmo, E.P., Materials and Processes in Manufacturing, Collier Macmillan, New York. • Lindberg, R.A., Processes and Materials of Manufacturing, Allyn and Bacon, Boston, 1 • Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, Prentice Hall, New York.

Title of the course	**: Work Study and Ergonomics**		
Subject Code	**: OEME301 (A)**		
Weekly load	: 3	LTP	3-0-0
Credits	: 3		

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Critical examination of existing engineering methods.

CO2: Develop and improved method of any engineering operation/process/system.

CO3: Identify the standard time for an operation/activity.

CO4: Able to design and development of product/systems with applications of ergonomics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	3	3	2	2	1	1
CO2	2	3	3	3	2	3	3	2	1
CO3	1	3	2	1	3	2	1	2	1
CO4	3	3	2	3	3	2	3	2	1
Avg.	2.33	2.75	2.25	2.5	2.75	2.25	2.25	1.75	1

Course Description	**Lecture(s)**
UNIT-I	
Method Study	**24**
Introduction to Work Study: Time study and method study, Objectives of work study, Method Study Procedure, factors for selection of Job for method study, Recording techniques: Charts, and Diagrams, Critical Examination, Principle of motion economy, Concept of Normal and maximum working area, Therbligs, Simo Chart, Micro motion study	
UNIT-II	
Time Study	**16**
Introduction to various work measurement techniques, Stop watch Time study: definition, equipment's, Types of stop watches, stop watch time study procedure: types of work elements, guidelines for breaking the job into various work elements. Work sampling: definition, procedure, design of work sampling plans. PMTS: various methods, MTM-1 Rating: Definition, Types of rating Techniques, Standard Performance, Normal Time, Observed Time and Standard Time, Uses of Standard Time, Allowances.	
Ergonomics	**08**
Definition, Components of Ergonomics: Anthropology, Physiology, Psychology and Machines, Design principles, Anthropometry: Definition, Structural Body Dimensions and Functional Body Dimensions, Seat Design, Design recommendations for seat design. Displays and controls: Types, design recommendations, design of control panels	
	Total=48

Recommended Books:

1. NPC, A Manual of Method Study
2. ILO, Work Study
3. Dalela and Sharma, Work Study and Ergonomics, Standard
4. Barnes, Motion and Time Study, John Wiley

Title of the course : **Computer Aided Design**
Subject Code : **OEME301 (B)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Understand the application of computers in Design.
CO2: To understand the fundamentals of CAD.
CO3: Acquired skill for modeling and analysis in software.
CO4: Designing and analysis ability in field of modeling the parts.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	3	2	1	1	2	3	1
CO2	3	3	2	3	1	1	1	2	1
CO3	2	3	3	2	1	1	2	2	1
CO4	3	2	3	2	1	1	1	3	2
Avg.	2.75	2.5	2.75	2.25	1	1	1.5	2.5	1.25

Course Description	**Lecture(s)**
Unit-I	
Fundamentals of CAD	
Introduction to CAD. Applications of CAD. Design process and application of computers in design. Benefits of CAD/CAM.	07
CAD Interface	
Input devices: Keyboard, Touch panel, Light pens, Graphic tablets, Joysticks, Trackball, Mouse, Voice systems. Output devices: Storage, Printers. Display devices: Tube graphics display, Raster refresh graphics display, Plasma panel displays, Liquid crystal displays. Central Processing Unit (CPU). Graphic Standards: GKS, IGES, PHIGS. Data Structure and Database Management of a Graphics System. Coordinate Systems: WCS, MCS, SCS. Software modules: Operating System, Graphics, Application, Programming and Communication.	08
AutoCAD	
Introduction to AutoCAD; Installation and starting AutoCAD; Types of co-ordinate systems; Introduction to screen area; menu bars and tool bars; Set the drawing space; Procedure for making, saving a drawing.	09
UNIT II	
Geometric Transformations	08
Formulation, translation, rotation, scaling, reflection, mapping of geometric models, projections. Basic concepts of hidden surface removal and shading.	
Geometric modeling	
Introduction to geometric modeling, Analytical curves: parametric and non-parametric equations; Bezier Curves; Introduction to free form curves B-spline and NURBS; Surfaces: plane, cylindrical, spherical, ruled, coons patch, swept, revolved, Bezier, B-spline. patch. Introduction to solid models; Solid representation, B-rep. CSG, Sweep representation.	10
Introduction to Assembly-modeling	06
Introduction to assembly, Top-Down and Bottom-up Modeling Assemblies, Constrains and mating conditions in assembly, Data transfer formats.	

Total=48

Recommended Books:

Title	*Author(s)*	*Publisher*
CNC Machines	Pabla BS and Adithan	New Age Publishers (P) Ltd, New Delhi
CAD/CAM	Grover and Zimmers	Prentice Hall of India; New Delhi
Computer Aided Manufacturing	Rao, Kundra and Tiwari	Tata McGraw Hill, New Delhi.
Mechatronics	HMT	Tata McGraw Hill

Title of the course : **Safety Engineering**
Subject Code : **OEME301 (C)**
Weekly load : 3 LTP 3-0-0
Credits : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to-

CO1: Understand various aspects of safety engineering.

CO2: Gain knowledge about industrial safety and hazards.

CO3: Able to calculate the cost of accidents and hazards.

CO4: Understand basic job safety analysis.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	1	2	2	2	1	1
CO2	3	1	3	1	2	2	3	3	2
CO3	3	1	1	1	2	2	2	1	1
CO4	3	1	1	1	2	2	2	1	1
Avg.	3	1	1.5	1	2	2	2.25	1.5	1.25

Course Description	**Lecture(s)**
UNIT-I	
Introduction	**06**
Safety -Goals of safety engineering. Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. History of the safety movement. Theories of accident causation.	
Safety organization	
Objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages	**06**
Housekeeping	**06**
Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping.	
Work permit system	**06**
Objectives, hot work and cold work permits. Typical industrial models and methodology.	
UNIT-II	
Personal protection in the work environment	**06**
Types of PPEs, Personal protective equipment- respiratory and non-respiratory equipment. Standards related to PPEs.	
Monitoring Safety Performance	**06**
Frequency rate, severity rate, incidence rate, activity rate.	
Cost of accidents	**06**
Computation of Costs- Utility of Cost data. Plant safety inspection, types, inspection procedure. Safety sampling techniques. Job safety analysis (JSA), Safety surveys, and Safety audits. Safety Inventory Technique.	
Accident investigation	**06**
Why? When? Where? Who? & How? Basics- Man- Environment &Systems. Process of Investigation –Tools-Data Collection-Handling witnesses- Case study.	
	Total=48

Recommended Books:

1. N.V. Krishnan, Safety Management in Industry, Jaico Publishing House, 1997
2. Ronald P. Blake, Industrial Safety, Prentice Hall, New Delhi, 1973
3. David L. Goetsch, Occupational Safety and health, Prentice Hall
4. Ted S. Ferry, Modern Accident Investigation and Analysis, John Wiley & Sons
5. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall

Title of the course : **Robotics**
Subject Code : **OEME301 (D)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Obtain knowledge and understand the basic concepts of industrial robotics, namely in terms of classification, kinematics,

CO2: To acquire knowledge on applications of Actuation, end effectors and sensors in robotics

CO3: Ability to Program industrial (manipulator) robots.

CO4: Understand the context and importance of robotics in the different society sectors.

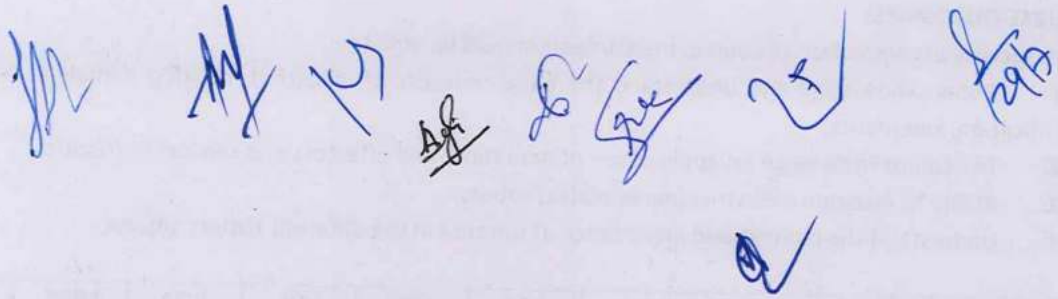
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	1	1	1	1	2	1	1
CO2	3	3	1	1	1	1	2	1	1
CO3	3	1	2	1	2	1	2	2	1
CO4	3	1	2	1	2	1	2	2	1
Avg.	2.6	1.8	1.4	1	1.4	1	2	1.4	1

Unit	Main Topics	Course Description	Lecture(s)
Unit-1	Introduction	Evolution of robot and robotics, laws of robotics, robot anatomy: Links, joints, Degrees of freedom (DOF), Precision movement, robot specifications and work volume, Robots congiguration, Drives-Basic robot motions, Arm configuration, wrist configuration.	07
	End Effectors	End effectors classification-Mechanical, magnetic, vacuum and adhesive gripper.	05
	Sensors	Sensor device: Types of sensors- contact, position and displacement sensors, Force and torque sensors, Robot vision systems.	06
	Robot Actuation Systems	Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.	06
Unit-2	Kinematics	Coordinate frames, description of objects in space, fundamental transformation matrices, Denavit- Hartenberg Notation, kinematic relationship between adjacent links, Manipulator transformation matrix, introduction to Inverse kinematics	08
	Robot Programming	Robot language classification-programing methods off and online programming, Lead through method, Teach pendent method, Language, simple program.	06
	Control Hardware and Interfacing	Basics of control: open loop- closed loop, Control laws: P, PD, PID, Embedded systems: integration with sensors, actuators, components	06
	Industrial Applications	Application of robots- Material handling- machine loading and unloading, Assembly, Inspection, Welding, spray painting, Recent developments ion robots-safety considerations. AI in Robotics, Robotics and Automation for Industry 4.0, Robot safety and social robotics.	04
			Total = 48

Recommended Books:

1. Mittal and Nagrath, Robotics and Control, TMH.
2. J.J. Craig, Introduction to Robotics, Pearson Education.
3. S.R.Deb & S. Deb, Robotics Technology and Flexible Automation, Tata McGraw-Hill

4. John Blankenship, Samuel Misha. A Hardware Interfacing and Control Protocol: Using RobotBASIC and the Propeller, Createspace Independent Pub.
5. I.J. Nagrath Control Systems Engineering, New Age International Pvt Ltd



Title of the course : **Theory of Machine Lab.**
Subject Code : **PCME305**
Weekly load : 2 LTP 0-0-2
Credits : 1

Course Outcomes:

After successful completion of course, the students should be able to:

CO1: Enable to analyse the basic principles of various Components of the machines and their need in various applications.

CO2: Interpret the need of changes to modify or technically more advancement in the machine components according to their applications.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	3	1	3	2	3	2
CO2	3	3	3	3	1	3	2	3	2
Avg.	3	3	3	3	1	3	2	3	2

List of Experiments:

1. Study of kinematic pairs, kinematic chain.
2. Study and preparation of models of different kind of planar mechanism; four bar mechanism, single slider crank mechanism, double slider mechanism.
3. Demonstration of different kinds of CAM and Follower arrangements.
4. Construction of CAM with different types of followers for various kind of motions (on A2 size sheet).
   a. Knife edge follower with various kind of motion.
   b. Roller follower with various kind of motion.
5. Demonstration of different types of Gears.
6. Demonstration of different types of Gear train.
7. Determination of moment of inertia for flywheel.
8. Demonstration of different types of Governors.
9. Determination of height of Governor for varied spindle speed.
10. Determination of position and orientation of masses for balancing in different planes.

Title of the course : **Industrial Automation and Control Lab**
Subject Code : **PCME307**
Weekly load : 2 LTP 0-0-2
Credit : 1

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn fundamentals of Pneumatics and Hydraulics software

CO2: Acquire necessary skill for simulation of Pneumatics and Hydraulics ckts

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	3	1	3	2	3	2
CO2	3	3	3	3	1	3	2	3	2
Avg.	3	3	3	3	1	3	2	3	2

List of Experiments:

11. Familiarization with Automation Studio: Study of Pneumatics and Hydraulic Modules

12. Draw and Simulation of Simple Pneumatic Circuits using Automation Studio
    (a) Control of single acting cylinder using 3/2 DC valve
    (b) Control of double acting Cylinder using 3/2 and 5/2 DC valves
    (c) Speed Control of double acting cylinder: Throttle- in and Throttle-out
    (d) Demonstration of Pilot Operation

3. Draw and Simulation of Logic Gates using Automation Studio
4. Study and Performance on Pneumatic Trainer.
5. Study of Resistance, capacitance, Variable Resistance, Multimeter, Oscilloscope
6 Practice for making simple Circuits.
7 Project related to simulation of Pneumatics and Hydraulics using Automation Studio

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Title of the course	: **Industrial Engineering & Management Lab**
Subject Code	: **PEME303**
Weekly load	: 2 LTP 0-0-2
Credit	: 1

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Apply the fundamentals of Industrial Engineering

CO2: Acquire necessary skill for applying tools of industrial engineering

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	3	1	3	2	3	2
CO2	3	3	3	3	1	3	2	3	2
Avg.	3	3	3	3	1	3	2	3	2

List of Experiments:

1. Study and construct an operation Process chart of a given work
2. Study and construct a Flow Process chart of a given work
3. Study and construct a two-handed Process operation chart of a given work
4. To obtain practice in Rating Performance in walking
5. To obtain practice in rating Performance in card dealing
6. Brainstorming on a book, a steel Glass, coin or any thing
7. To study a Reaction Timer Model
8. To determine the standard time, Reassemble and Assembly of different bolts by using Dexterity ring apparatus
9. To determine the standard time, Reassemble and Assembly of different Bolts by Hand Tool Dexterity Apparatus
10. Work sampling exercises

Title of the course : **CAD/CAM**
Subject Code : **PCME302**
Weekly load : 03 LTP 3-0-0
Credit : 03

COURSE OUTCOMES:

After successful completion of the course, the students should be able to

CO1: Enhance the knowledge of the application of computers in designing and Manufacturing.
CO2: Use CAD software to produce designs and CNC programming
CO3: To understand the fundamentals of CNC machines, additive manufacturing and industrial robots.
CO4: Obtain knowledge and understand of parts and of maintenance of CNC machines

Pre-requisite knowledge:

COs	Programme Outcomes (POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	2	3	3	3	3	3
CO2	3	3	3	1	1	3	3	3	2
CO3	3	1	2	3	1	2	2	2	3
CO4	3	3	3	2	3	3	3	3	3
	3	2.5	2.75	2	2	2.75	2.75	2.75	2.75

Course description	**Lectures**
Unit I	
Introduction to CAD	
Introduction to CAD concepts; Basic design process and application of computer at different stages in the design process; CAD/CAM database; Benefits of CAD; Configuration of graphics system; . CAD workstations and their historical development; CPU; input devices; output devices.	10
AutoCAD	
Introduction to AutoCAD; Installation and starting AutoCAD; Types of co-ordinate systems; Introduction to screen area; menu bars and tool bars; Set the drawing space; Procedure for making, saving a drawing.	7
Introduction to CAM	
Basic concepts of NC system; ; NC co-ordinate systems; Problems of conventional NC systems; CNC and DNC systems, their procedure, advantages and applications; Additive manufacturing; basic concepts of industrial robotics.	7
Unit II	
CNC Machines	
Components of CNC system: machine control unit, machine tool, different types of NC control systems and their applications; Classification of NC machines.	6
Construction details of CNC machines	
Introduction; Machine structure; Slideways/Guideways; Spindle; Drive unit; Automatic tool changes, Multiple pallets; Swarf removal mechanism; Safety provisions; Introduction to sensors and feedback mechanism;	6
Maintenance of NC machines	
Types of maintenance of NC machines; Maintenance practices; Problems related to mechanical, electronic and pneumatic systems;	4
Part programming	
Basic concepts of part programming; NC words; Part programming formats; Simple programming for rotational and prismatic components; Canned cycles; Sub routines and do loops, tool off-sets; Cutter radius compensation. Introduction to robotic programing.	8
Total lectures	48

Recommended Books:

Title	*Author(s)*	*Publisher*
CNC Machines	Pabla BS and Adithan	New Age Publishers (P) Ltd, New Delhi
CAD/CAM	Grover and Zimmers	Prentice Hall of India; New Delhi
Computer-Aided Engineering Drawing	S. Trymbaka Murthy	I.K. International, New Delhi
Mechatronics	HMT	Tata McGraw Hill

Title of the course : **Design of Machine elements**
Subject Code : **PEME302**
Weekly load : 4 LTP 3-1-0
Credit : 4

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Learn fundamentals of design and design procedures of various machine components.

CO2: Evaluate critical factors for the design of components.

CO3: Design a machine component and associated safety factors.

CO4: Applying the design principles to design a machine component.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	1	1	1	3	1	1
CO2	1	2	2	1	1	1	1	2	1
CO3	1	2	3	2	1	1	1	2	1
CO4	1	3	3	2	1	1	3	3	2
Avg.	1.5	2	2.25	1.5	1	1	2	2	1.25

Course Description	Lecture(s)
Unit-I	
Introduction	
Introduction to design procedure, design requirements, review of force analysis concepts, factor of safety, concept of stress concentration and mechanical properties. General design considerations like fatigue, creep, fabrication methods, economic considerations, material selection and ergonomics. (Introduction Only)	02
Riveted and Welded Joints	
Type of riveted joints. Possible failure of riveted joints. Strength and efficiency of Butt (Single plate & double cover plate) and Lap riveted joints. Design of Longitudinal butt joint for Boiler. Common types of welded joints. Simple design for V-butt welded joints. Transverse fillet and parallel fillet welded joint for simple loading.	08
Screwed Joints	
Introduction to term screw and various definitions of screw threads. Advantages and Disadvantages of screwed joints. Form of screw threads. Common types of screw fastening; through bolt, tap bolt, stud, cap screw, machine screw and set screw. Designation of screw threads. Stresses in screw fastening. Design of bolts for cylindrical cover.	06
Shafts	
Design for static loading; stresses in shaft, design of shaft subjected to bending moment or torsion moment and combined bending and torsion moments. Failure theories (Introduction and overview only). Design of shaft based on rigidity.	08
Unit-II	
Keys and Couplings	
Definition of term "key" & its various types. Splines. Forces acting on sunk keys. Shaft couplings and its various types Design of flange shaft coupling; protected and unprotected.	08
Brakes	
Introduction, heat generation equation, design of shoe, bandbrake and combination of shoe and band brake.	06
Springs	
Introduction and classification of Springs. Design of Helical Springs.	04
Gears	

Introduction and classification of Gears. Design of spur gear.	06

Total=48

Recommended Books:

1. Shigley, J.E., and Mischke, C.R., "Mechanical Engineering Design (in S.I. Units)", 6th Ed., Tata McGraw-Hill, 2006.
2. Juvinall, R.C., and Marshek, K.M., "Fundamentals of Machine Component Design", 4th Ed., John Wiley & Sons, 2006.
3. Sharma & Aggarwal, "A Textbook of Machine Design", Katson.
4. Machine Design-An Integrated Approach, Norton, Pearson Education.
5. Mahadevan, K., and B., Reddy, "Design Data Handbook", CBS Publishers, 2003.
6. P. S. G, "Design data handbook", P. S. G., Coimbatore.

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Title of the course	: **Estimation & Costing**
Subject Code	: **PEME304**
Weekly load	: 4 LTP 3-1-0
Credit	: 4

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: learning the concepts of estimation and costing and depreciation. Analysing the depreciation cost of a given component

CO2: Learning the concepts of material cost, labour cost and expenses and determining the estimation and costing of a product.

CO3: Ability to estimate the various machining, welding, sheet metal, foundry and forging operations and the costing of the products manufactured.

CO4: Understanding the concept of Process costing, and types of Budget, and familiarization with accounting terminology

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	2	1	1	2	3	1
CO2	3	2	2	2	1	1	1	3	1
CO3	2	1	1	1	1	1	1	2	1
CO4	3	2	3	2	1	1	1	3	2
Avg.	2.75	1.5	1.75	1.75	1	1	1.25	2.75	1.25

	Lecture(s)
Unit-I	
Introduction	
Introduction to estimation and costing Definition, Importance and Aims- Qualities and functions of an Estimator, Need or purpose of estimation and costing in engineering field, Difference between costing and estimating- - Costing and cost accounting, methods of costing, functions of cost estimation, estimating procedures.	08
Elements of costing	
Cost structure, overheads, Depreciation, and obsolescence: Definition, types, and methods to calculate depreciation. Components of cost - prime cost, factory cost, office cost, total cost. Determination of selling price - Break even analysis	08
Material cost, Labour Cost and expenses	
Material cost; Direct material and indirect material costs, and their examples- Calculation of material cost - Labour cost; Direct and indirect labour costs, and their examples - Calculation of labour cost – Expenses; Direct and indirect expenses and their examples- Classification of expenses - factory, administrative, selling and distribution expenses - Fixed and variable expenses.	08
Unit-II	
Estimation in Machine shop and Welding shop, Sheet metal and other Shops	
Procedure of estimating cost of machined part for common Lathe operations (Facing, turning, boring, drilling and threading etc.). Estimation in welding shop - gas welding cost, arc welding cost - production cost of given. welding job- the types of welding costs	08
Estimation in Sheet metal, Foundry and Forging Shops	

Estimation in sheet metal shop - Estimate the material required for preparation of container open on one side, cylindrical drum, funnel, and tray etc. Estimation in foundry and forging shops- Procedure for estimating cost of pattern making. - Procedure for estimating foundry cost of components such as C.I pulley and C.I. etc.	08
Process Costing and accounting	
Process & Job Costing -Characteristics -Principles -Procedure for Process costing. Wages and Incentives and their types, Introduction to Budget and its types, accounting terminology like -book value-Net Present Value-Work in progress- Gross Domestic Product (GDP)-balance sheet-Tendering manual tendering and e-tendering.	08

Total=48

Recommended Books:

1. Mechanical estimation and costing by T.R.Banga and S.C.Sharma, Khanna publishers

2. Mechanical costing and estimation by Singh and Khan, Khanna Publishers

3. Mechanical estimation and costing by BP Sinha, Tata McGraw Hill

4. Process planning & cost estimation by M.Adithan, New age International

Title of the course : **Additive Manufacturing**
Subject Code : **OEME302 (A)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Demonstrate appropriate level of understanding on principles of additive manufacturing processes.

CO2: Choose appropriate materials for additive manufacturing processes.

CO3: Explore the applications of AM processes in various fields.

CO4: Develop physical prototypes by identifying suitable processes with optimum process parameters.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	3	2	2	3	3	1
CO2	3	3	2	3	3	3	2	2	2
CO3	3	3	2	3	3	2	2	3	2
CO4	3	3	3	3	3	3	2	3	3
Avg.	3	3	2.5	2.75	2.75	2.5	2.25	2.75	2

Course Description	**Lecture(s)**
Unit-I	
Introduction	
General overview, Introduction to reverse engineering Traditional Manufacturing v/s AM Computer Aided Design (CAD) and Manufacturing (CAM).	04
Materials science for AM	
Discussion on different materials used; Use of multiple materials, multifunctional and graded materials in AM; Role of solidification rate; Evolution of non-equilibrium structure; Structure property relationship; Grain structure and microstructure	12
Types of AM Processes	
Introduction to layered manufacturing; Importance of Additive Manufacturing; Additive Manufacturing in Product Development; Classification of additive manufacturing processes.	08
Unit-II	
Additive Manufacturing Technologies	
Common additive manufacturing technologies; Fused Deposition Modeling (FDM), Selective Laser Sintering (SLS), Stereo Lithography (SLA), Selection Laser Melting (SLM), Jetting, 3D Printing, Laser Engineering Net Shaping (LENS), Laminated Object Manufacturing (LOM), Electron Beam Melting (EBM); Capabilities, materials, costs, advantages and limitations of different systems.	16
Process selection, planning, control for AM	
Selection of AM technologies using decision methods, Additive manufacturing process plan: strategies and post processing. Monitoring and control of defects, transformation	08
	Total=48

Recommended Books:

1. Venuvinod, Patri K., and Weiyin Ma. Rapid prototyping: laser-based and other technologies. Springer Science & Business Media, 2013.
2. Ian Gibson, David Rosen, and Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, New York, NY, 2015.
3. Kumar, L. Jyothish, Pulak M. Pandey, and David Ian Wimpenny, eds. 3D printing and additive manufacturing technologies. Singapore: Springer, 2019.

4. Jacobs, Paul F. "Fundamentals of stereolithography." In 1992 International Solid Freeform Fabrication Symposium. 1992.

Title of the course : **Computer Aided Manufacturing**
Subject Code : **OPME302 (B)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Understand the application of computers in Manufacturing.
CO2: To understand the fundamentals of CNC machines.
CO3: Acquired skill for part programming.
CO4: Understand automation in manufacturing.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	3	2	1	1	2	3	1
CO2	3	3	2	3	1	1	1	2	1
CO3	2	3	3	2	1	1	2	2	1
CO4	3	2	3	2	1	1	1	3	2
Avg.	2.75	2.5	2.75	2.25	1	1	1.5	2.5	1.25

Course Description	**Lecture(s)**
Unit-I	
Fundamentals of CAM	
CAM - concept and definition, NC (Numerical Control), CNC (Computerized Numerical Control) and DNC (Direct Numerical Control) - concept, features and differences, Advantages and limitations of CNC, Selection criteria for CNC machines.	08
Constructional features of CNC machines.	
CNC machines: Types, classification, working and constructional features, Spindle drives and axes drives on CNC machines, Elements of CNC machines - Types, sketch, working and importance of Slide ways, Re-circulating ball screw, Feedback devices (transducers, encoders), Automatic tool changer (ATC), Automatic pallet changer (APC). CNC axes and motion nomenclature, CNC tooling : Tool presetting-concept and importance, Qualified tools-definition need and advantages, Tool holders- types and applications.	10
CNC Turning & Machining Centers.	
CNC turning centres: Types, Features, Axes nomenclature, Specification, holding devices - types, working and applications, Tool holding and changing devices - types, working and applications. CNC machining centres: Types, Features, axes nomenclature, Specification, Work holding devices-types, working and applications. Tool holding and changing device types, working and applications.	8
UNIT II	
NC part programming	
Definition and importance of various positions like machine zero, home position, work piece zero and programme zero. NC part programming: programming format and structure of part programme, G and M codes for turning and milling-meaning and applications of important codes, Simple part programming for straight turning, taper turning (linear interpolation) and convex/concave turning (circular interpolation). Simple part programming for milling. Importance, types, applications and format for: Canned cycles, Macros. Do loops, Subroutines. NC turning and milling part programming using canned cycles, Do loops and Subroutines.	12
Recent trends in CAM	

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Interfacing standards for CAD/CAM - Types and application, Adaptive control- definition, meaning, block diagram, sources of variability and applications. Flexible Manufacturing System (FMS) - concept, evaluation, main elements and their functions, layout and its importance, applications. Computer Integrated Manufacturing (CIM) - Concept, definition, areas covered, benefits. Robotics- definition, terminology, classification and types, elements and applications. Rapid prototyping - Concept and application	10

Total=48

Recommended Books:

Title	*Author(s)*	*Publisher*
CNC Machines	Pabla BS and Adithan	New Age Publishers (P) Ltd, New Delhi
CAD/CAM	Grover and Zimmers	Prentice Hall of India; New Delhi
Computer Aided Manufacturing	Rao, Kundra and Tiwari	Tata McGraw Hill, New Delhi.
Mechatronics	HMT	Tata McGraw Hill

Title of the course : **Engineering Estimation & Costing**
Subject Code : **OEME302 (C)**
Weekly load : 3 LTP 3-0-0
Credit : 3

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: learning the concepts of estimation and costing.

CO2: Learning the concepts of material cost, labour cost and expenses and determining the estimation and costing of a product.

CO3: Ability to estimate the cost of the products manufactured in various engineering fields.

CO4: Understanding the concept of Process costing, and types of Budgets, and familiarization with accounting terminology.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	2	1	1	2	3	1
CO2	3	2	2	2	1	1	1	3	1
CO3	2	1	1	1	1	1	1	2	1
CO4	3	2	3	2	1	1	1	3	2
Avg.	2.75	1.5	1.75	1.75	1	1	1.25	2.75	1.25

Course Description	Lecture(s)
Unit-I	
Introduction	
Introduction to estimation and costing Need or purpose of estimation and costing in engineering field, Difference between costing and estimating- - Costing and cost accounting, methods of costing, functions of cost estimation, estimating procedures.	08
Elements of costing	
Cost structure, overheads, Depreciation, and obsolescence, Methods to calculate depreciation. Components of cost - prime cost, factory cost, office cost, total cost. Determination of selling price - Break even analysis	08
Material cost, Labour Cost, and expenses	
Material cost; Direct material and indirect material costs, and their examples- Calculation of material cost - Labour cost; Direct and indirect labour costs, and their examples - Calculation of labour cost – Expenses; Direct and indirect expenses and their examples- Classification of expenses - factory, administrative, selling and distribution expenses - Fixed and variable expenses.	08
Unit-II	
Estimation of the various engineering works	08
Estimation of building and civil engineering works; Subheads of Various Items of Works, Abstracting Bill of Quantities, Preparation of Detailed Estimate, Contingencies Work. Estimation of electrical work; Define the terms - earthing, touch potential and step potential, list the methods of reducing earth resistance, Estimation of interior wiring, distribution lines and other related electric work. Preparation of estimate of a given civil and electric work.	
Estimation in Sheet metal, Foundry and Forging Shops	
Estimation in sheet metal shop - Estimate the material required for preparation of container open on one side, cylindrical drum, funnel, and tray etc. Estimation in foundry and forging shops- Procedure for estimating cost of pattern making. - Procedure for estimating foundry cost of components such as C.I pulley and C.I. etc.	08

Process Costing and accounting	
Process & Job Costing -Characteristics -Principles -Procedure for Process costing. Wages and Incentives and their types, Introduction to Budget and its types, accounting terminology like -book value-Net Present Value-Work in progress- Gross Domestic Product (GDP)-balance sheet-Tendering manual tendering and e-tendering.	08

Total=48

Recommended Books:

1.Mechanical estimation and costing by T.R.Banga and S.C.Sharma, Khanna publishers

2. Mechanical costing and estimation by Singh and Khan, Khanna Publishers

3. Mechanical estimation and costing by BP Sinha, Tata McGraw Hill

4. Process planning & cost estimation by M.Adithan, New age International

Title of the course	: **Supply Chain Management**	
Subject Code	: **OEME302 (D)**	
Weekly load	: 3	LTP 3-0-0
Credit	: 3	

COURSE OUTCOMES:

After successful completion of course, the students should be able to

CO1: Knowledge gain about the fundamental concept of supply chain management

CO2: Analyze the design and role of distribution networks, including e-business advantages and disadvantages.

CO3: Explore IT's impact on SCM and logistics coordination.

CO4: Apply demand management techniques in forecasting and planning through case studies

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	1	1	2	2	3	2
CO2	2	3	3	2	2	2	2	2	3
CO3	2	2	2	3	2	3	3	3	2
CO4	2	3	3	3	2	3	3	3	3
Avg.	2.25	2.5	2.25	2.25	1.75	2.5	2.5	2.75	2.5

Course Description	**Lecture(s)**
Unit-I	
Introduction	6
Supply Chain, Supply Chain Management (SCM); Objectives, Importance, Activities, Process View, Drivers and Barriers. Four P's' model.	
Designing the Supply Chain Network	10
Definition and Role of Distribution Network and its Influencing Factors. E-Business; advantages and disadvantages. Supply chain model.	
Transportation in Supply Chain	8
Definition, Role of transportation in SCM; Importance, Modes, Infrastructure, Modes, Policies. Routing and Scheduling.	
Unit-II	
Information Technology in Supply Chain	8
Introduction, Supply Chain IT Framework, Role of IT in SCM, Customer Relationship Management (CRM), Supplier Relationship Management (SRM), Enterprise Resource Planning (ERP), E-Commerce.	
Coordination in Supply Chain & Logistics	8
Introduction, Lack of Supply Chain Coordination, Collaborative Planning, Forecasting and Replenishment (CPFR), Logistics Activities, Approach to Analysing Logistics Systems.	
Demand and Customer Service	8
Introduction, Outbound to Customer Logistics Systems, Supply and Demand Relationship; Graphical Representation, Demand Management; Process, Forecasting, Planning. Case Study.	
	Total=48

Recommended Books	
Title (Authors)	**Online Available Link**
Supply Chain Management (Sedat Aydin)	file:///C:/Users/User/Downloads/3.SupplySupplierSupplyManagementSupplyChainSupplyChainManagement.pdf

Fundamentals of Supply Chain Management (Dr. Dawei Lu)	https://library.ku.ac.ke/wp-content/downloads/2011/08/Bookboon/Magement%20andOrganisation/fundamentals-of-supply-chain-management.pdf
Supply Chain Management	https://sjce.ac.in/wp-content/uploads/2021/10/jnu-Supply-Chain-Management.pdf

Title of the course : **CAD/CAM Lab**
Subject Code : **PCME304**
Weekly load : 2 LTP 0-0-2
Credit : 1

COURSE OUTCOMES:

After successful completion of the course, the students should be able to

CO1: Enhance the knowledge of the application of CAD software in drawing and modeling

CO2: To understand the fundamentals of CNC machines, additive manufacturing and industrial robots.

CO3: Obtain knowledge, understand implementation of CNC programming

Pre-requisite knowledge:

COs	Programme Outcomes (POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	S	S	S	M	S	S	S	S	S
CO2	S	S	S	W	W	S	S	S	M
CO3	S	W	M	S	W	M	M	M	S

List of experiments:

Exp. No.	Title
1.	Introduction to AutoCAD
2.	Draw the 2D drawings of components using line command and write the procedure.
3.	Draw the 2D drawings of components using line command and write procedure of the same
4.	Draw the 2D drawing of the given parts using appropriate modify commands
5.	Draw the 2D drawing of the given parts using appropriate modify commands
6.	Draw front view full section and top view of the given drawings
7.	To study about the general instruction of CAD/CAM lab and safety precautions of CNC both lathe and milling M/C.
8.	To study the constructional details of CNC lathe machine
9.	Study of lathe bed & slide ways
10.	To study the construction and working of (a) Automatic Tool changer (b) Pallets
11.	To study the constructional details of CNC milling machine
12.	Write a programme of turning / step turning using G-codes M-codes for a given job on CNC lathe machine
13.	Write a program for threading operation using G& M-codes on lathe machine of a given job.
14.	Write a program on CNC Milling Machine using G & M Code for the given drawing