GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013.

B.E. PRODUCTION ENGINEERING (FULL TIME)

THIRD SEMESTER

Sl. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22PES306	Thermal Systems and Heat Transfer	ES	40	60	100	3	1	0	4
2	22PES307	Engineering Mechanics (Common to CIVIL, EEE & PRODN Branches)	ES	40	60	100	3	0	0	3
3	22PPC301	Machine Tools and Processes	PC	40	60	100	3	0	0	3
4	22PPC302	Engineering Metallurgy	PC	40	60	100	3	0	0	3
5	22PPC303	Manufacturing Technology	PC	40	60	100	3	0	0	3
6	22PMC3Z2	Constitution of India (Common to all Branches)	MC	40	60	100	3	0	0	0
PRACTICAL										
7	22PPC304	Metallurgy Laboratory and Thermal Science Laboratory	PC	60	40	100	0	0	3	1.5
8	22PPC305	Manufacturing Processes Laboratory	PC	60	40	100	0	0	3	1.5
TOTAL				**360**	**440**	**800**	**18**	**1**	**6**	**19**

FOURTH SEMESTER

Sl. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22PBS408	Applied Probability and Statistics	BS	40	60	100	3	1	0	4
2	22PPC406	Fluid Mechanics and Machinery (Common to MECH & PRODN Branches)	PC	40	60	100	3	0	0	3
3	22PPC407	Mechanics of Materials	PC	40	60	100	3	1	0	4
4	22PPC408	CNC Technology	PC	40	60	100	3	0	0	3
5	22PPC409	Process Planning and Cost Estimation (Common to MECH & PRODN Branches)	PC	40	60	100	3	0	0	3
PRACTICAL										
6	22PES408	Engineering Exploration for Production Engineering	ES	100	--	100	0	0	3	1.5
7	22PPC410	Strength of Materials and Fluid Machinery Laboratory (Common to MECH & PRODN Branches)	PC	60	40	100	0	0	3	1.5
8	22PPC411	Production Drawing	PC	60	40	100	0	0	3	1.5
TOTAL				**420**	**380**	**800**	**15**	**2**	**9**	**21.5**

22PES306	**THERMAL SYSTEMS AND HEAT TRANSFER** *(Use of Approved Steam table and Refrigeration and Air conditioning table is permitted)*	**SEMESTER III**

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	1	0	4

Course Objectives	*To enable the students to understand the basic laws of Thermodynamics, Heat and mass transfer and the principle of operation of thermal equipment like IC engine, boiler, and refrigerator etc.,	
UNIT- I	**THERMODYNAMICS**	**(9+3 Periods)**
Thermodynamic systems - zeroth law, first and second laws of thermodynamics, applications, steady flow energy equation, ideal gas processes - calculation for work done, heat transfer and entropy changes.		
UNIT- II	**POWER PLANTS**	**(9+3 Periods)**
Properties of steam: P-V, T-S, and H-S diagrams- Rankine cycle (without reheat and regeneration), Steam power plant, Brayton cycle, gas turbine power plant, cogeneration and combined cycle power plants.		
UNIT- III	**IC ENGINES**	**(9+3 Periods)**
Carnot cycle, Otto, diesel cycles, Principles of operations of IC Engines, valve and port timing diagrams, indicator diagrams; diesel fuel pump and injector, need for cooling and lubrication of IC engines, coil and magneto ignition systems, mechanical, brake thermal and indicated thermal efficiencies.		
UNIT- IV	**REFRIGERATION AND AIR-CONDITIONING**	**(9+3 Periods)**
Refrigeration- vapour compression cycle - vapour absorption cycle, comparison between vapour compression and absorption systems. Psychrometry, Psychrometric chart– processes– summer and winter air conditioning systems.		
UNIT- V	**HEAT TRANSFER**	**(9+3 Periods)**
Heat conduction through plane and cylinder, critical thickness of insulation, natural and forced convection. Radiation, Surface emission properties, Stefan-Boltzmann law, Kirchhoff'slaw.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK:

1	*Mahesh M Rathore, "**Thermal Engineering**", McGraw Hill Education (India) Private Limited, Chennai, 2010.*
2	*Yunus A Cengel**" Introduction to Thermodynamics and Heat Transfer",** McGraw Hill Inc., New York, 2007.*

REFERENCES:

1	*Nag.P.K ,**"Engineering Thermodynamics",**TataMcGraw-Hill,NewDelhi,2008.*
2	*R.K.Rajput **"Thermal Engineering",** Laxmi Publications (P) Ltd, 6th edition New Delhi, 2006.*
3	*Kothandaraman.C.P.,Domkundwar.S .and A.V.Domkundwar **"Acourse in T hermal Engineering",** Dhanpat Rai and Sons.,5th edition, 2000.*
4	*Holman.J.P **"Heat and MassTransfer",** 3rd Edition, McGraw-Hill, 2007.*
5	*GanesanV **"Internal Combustion Engines",** Tata McGraw Hill Publishing company, New Delhi ,2007.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Determine the change of properties and energy transfer during different thermodynamic processes in closed system using idealgas.	K3
CO2	Calculate the thermal efficiency of the Rankine cycle.	K3
CO3	Determine the air standard efficiency of the Otto cycle and Diesel cycle.	K3
CO4	Describe the vapour compression and vapour absorption refrigeration systems.	K2
CO5	Calculate the heat flow rate in a plane wall and hollow cylinder by conduction.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2	2	2	-	-	-	1	3	1	1	-	1	1
CO2	2	3	2	2	2	-	-	-	1	3	2	1	-	1	1
CO3	2	3	2	2	2	-	-	-	1	3	3	1	-	1	1
CO4	-	1	1	2	2	-	-	-	1	3	1	1	-	1	1
CO5	2	3	2	2	2	-	-	-	1	3	3	1	-	1	1
22PES306	**2**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**3**	**2**	**1**	**-**	**1**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.6, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 9.2.1, 10.1.1, 10.1.2, 10.1.3, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.2.2, 12.3.2
CO2	1.1.1,1.1.2.1.3.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.4,3.1.1,3.1.2,3.1.6,3.3.1,3.4.1,4.1.1,4.1.2,4.3.1,4.3.3,4.3.4,5.1.1,5.2.1,5.2.2,5.3.1,9.2.1,10.1.1,10.1.2,10.1.3,10.2.2,10.3.1,10.3.2,11.3.1,11.3.2,12.2.2,12.3.2
CO3	1.1.1,1.1.2,1.3.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.4,3.1.1,3.1.2,3.1.6,3.3.1,3.4.1,4.1.1,4.1.2,4.3.1,4.3.3,4.3.4,5.1.1,5.2.1,5.2.2,5.3.1,9.2.1,10.1.1,10.1.2,10.1.3,10.2.2,10.3.1,10.3.2,11.1.1,11.2.1,11.3.1,11.3.2,12.2.2,12.3.2
CO4	2.1.1,2.4.4,3.1.2,3.1.6,3.3.1,3.4.1,4.1.1,4.2.1,4.3.1,4.3.4,5.1.2,5.2.1,5.2.2,9.2.1,10.1.1,10.1.2,10.1.3,10.2.2,10.3.1,10.3.2,11.3.1,12.2.2,12.3.2
CO5	1.1.1,1.1.2,1.3.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.4,3.1.1,3.1.2,3.1.6,3.3.1,3.4.1,4.1.1,4.1.2,4.3.1,4.3.3,4.3.4,5.1.1,5.2.1,5.2.2,5.3.1,9.2.1,10.1.1,10.1.2,10.1.3,10.2.2,10.3.1,10.3.2,11.1.1,11.2.1,11.3.1,11.3.2,12.2.2,12.3.2

ASSESSMENT PATTERN– THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	10	30	60	-	-	-	100
CAT2	15	35	50		-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	40	60	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	35	65	-	-	-	100
ESE	10	30	60	-	-	-	100

22PES307	**ENGINEERING MECHANICS** (Common to CIVIL, EEE & PRODN Branches)	**SEMESTER III**

PREREQUISITES	**CATEGORY**	**L**	**T**	**P**	**C**
NIL	**ES**	**3**	**0**	**0**	**3**

Course Objectives	*To learn the basic principles and concepts of force system. *To gain knowledge on different kinds of friction. *To understand the concepts of centre of gravity and moment of inertia. *To understand the Kinematics and kinetics of rigid body motion. *To study the dynamics of particles, impulse and momentum Principles.	
UNIT- I	**BASIC CONCEPTS OF FORCES**	**(9 Periods)**
Basic Concepts and Principles of Forces– Laws of Mechanics – System of forces in Plane – Free body Diagrams- resultant of a force system – resolution and composition of forces – Lami's theorem – moment of a force – physical significance of moment-Varignon's theorem – resolution of a force and couple system– forces in space – addition of concurrent forces in space – equilibrium of a particle in space.		
UNIT- II	**STATIC AND DYNAMIC FRICTION**	**(9 Periods)**
Frictional resistance – classification of friction- laws of friction – coefficient of friction-angle offriction –angle of repose– cone of friction – advantages - equilibrium of a body on a rough inclinedplane –ladder friction – rope friction – wedge friction		
UNIT- III	**PROPERTIES OF SECTION**	**(9 Periods)**
Centroid and Centre of Gravity for simple & Composite sections– theorems of moment of inertia Determination of moment of inertia of various sections –Product of Inertia – Principal moment of inertia of plane areas - Mass moment inertia of circular plate, Cylinder, Cone, Sphere.		
UNIT- IV	**BASICS OF DYNAMICS - KINEMATICS**	**(9 Periods)**
Kinematics and kinetics – displacements, velocity and acceleration - Equations of motion –Rectilinear motion of a particle with uniform velocity, uniform acceleration, varying acceleration– motion under gravity – relative motion – curvilinear motion of particles – projectiles– angle of projection – range – time of flight and maximum height		
UNIT- V	**BASICS OF DYNAMICS - KINETICS**	**(9 Periods)**
Newton's second law of motion – linear momentum – D'Alembert's principle, Dynamic equilibrium– equation of particles-principle of work and energy –law of conservation of energy –Principle of impulse and momentum – Equations of momentum – Laws of conservation of momentum. Impact – Time of compression, restitution, collision – Co-efficient of restitution – types of impact – collision of elastic bodies by direct central impact and oblique impact – collision of small body with a massive body – Kinetic energy of a particle.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*F.B. Beer and E.R. Johnson, **"Vector Mechanics for Engineers",** Tata Mc.Graw Hill Pvt Ltd,11th Edition, 2013.*
2	*Rajasekaran S &Sankara Subramanian, "**Fundamentals of Engineering Mechanics**", Vikas Publishing House Pvt Ltd. 3rdEdition, 2017*

REFERENCES:

1	*S. Timoshenko and Young, "**Engineering Mechanics**", McGraw Hill, 4th Edition, 2017.*
2	*Bansal R.K, "**A Text Book of Engineering Mechanics**", Laxmi Publications, 2015.*
3	*R.C. Hibbeller, "**Engineering Mechanics**", Prentice Hall of India Ltd, 14th Edition, 2017.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Familiarize the principles and Concepts of Mechanics.	K2
CO2	Calculate the friction force acting on a plane under various conditions.	K3
CO3	Determine the centre of gravity and moment of inertia for different sections.	K3
CO4	Predict the Rectilinear and curvilinear motion of particles.	K3
CO5	Evaluate the dynamics of particles using kinetic principles.	K4

COURSE ARTICULATION MATRIX:

	a) CO and PO Mapping														
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	2	1	-	-	2	-	-	-	-	-	-	1	2	2
CO2	3	2	1	-	-	2	-	-	-	-	-	1	-	2	3
CO3	3	3	1	-	-	2	-	-	-	-	-	-	-	2	3
CO4	3	3	1	-	-	2	-	-	-	-	-	1	1	2	3
CO5	3	3	1	-	-	2	-	-	-	-	-	1	1	2	3
22PES307	**3**	**3**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial															

	b) CO and Key Performance Indicators Mapping
CO1	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.2, 2.4.3, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 6.1.1
CO2	1.1.1, 1.1.2, 1.2.1,1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 6.1.1, 12.2.2
CO3	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 6.1.1
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 6.1.1, 12.2.2
CO5	1.1.1, 1.1.2, 1.2.1,1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 6.1.1, 12.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	30	10	-	-	100
CAT2	30	30	30	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	30	30	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	30	30	10	-	-	100
ESE	30	30	30	10	-	-	100

22PPC301	MACHINE TOOLS AND PROCESSES	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	*To study different machine tools working principle and understand different types of mechanism using some special machine tools	
UNIT- I	**MACHINE TOOLS AND PROCESSES FOR PRODUCING ROUND SHAPES**	**(9 Periods)**
Engine Lathe – functions; work holding devices in lathe – functions – Chuck, Centre, Dogs, Steady Rest and Follower Rest; Mechanism of lathe – Apron, Feed, Tumbler Gear; various operations performed in Lathe – facing, turning, chamfering and knurling – relative positions of tool and job – Taper turning methods. Drilling machines – specifications, types - feed mechanism, operations – drill bit nomenclature.		
UNIT- II	**MACHINE TOOLS AND PROCESSES FOR PRODUCING VARIOUS SHAPES**	**(9 Periods)**
Milling – specifications – types - cutter nomenclature – types of cutters – milling processes – indexing – gear forming in milling – gear generation - gear shaping and gear hobbing. Broaching – specifications, types, tool nomenclature, broaching operations.		
UNIT- III	**SPECIAL PURPOSE MACHINE TOOLS**	**(9 Periods)**
Shaper machine – planner machine-slotter machine-working principle –types of operations – types of mechanism used-applications.		
UNIT- IV	**ABRASIVE MACHINING AND FINISHING OPERATIONS**	**(9 Periods)**
Abrasives - bonded abrasives - Grinding process- wheel, gear grinding operations and machines - grinding fluids - Design Consideration for Grinding - Finishing operations: Lapping, Honing, Burnishing- economics of grinding and finishing operation.		
UNIT- V	**MACHINE TOOL STRUCTURE AND AUTOMATION**	**(9 Periods)**
Machine tools structures -erecting and testing of machine tools- Vibration and chatters in machining- Automation: Capstan and Turret lathe - single spindle and multi spindle automats - Swiss type and automatic screw machines-Feeding Mechanisms-Transfer mechanism-Tracer controller Mechanism.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Hajra Choudhry S.K. and Bose S.K.,* ***"Workshop Technology Vol II",*** *Media Promoters and Publishers Pvt. Ltd., Bombay,12th edition, 2007.*
2	*Sharma P.C.,* ***"A Text Bookof Production Technology",****S.Chand and Company Ltd., New Delhi, 10th Revised edition, 2010*

REFERENCES:

1	*Khanna, O.P and Lal, M* ***"A Text Bookof Production Technology"****, Vol.II, DhanpatRai Publications (P) ltd.,1st Edition, 2009.*
2	*SeropeKalpakjian and Steven R.Schmid,* ***"Manufacturing Engineering and Technology"****, Addison Wesley Longman (Singapore) Pvt. Ltd, Delhi, 2009.*
3	*Jain R.K. and Gupta S.C"****Production Technology****"Khanna Publisher, New Delhi, 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe about various mechanism used in machine tools.	K2
CO2	Explain the processes involved in production of round shaped components.	K2
CO3	Explain the processes involved in production of prismatic and contour shapes.	K2
CO4	Discuss about various finishing operations.	K2
CO5	Explain the machine tool structure and mechanisms of automation.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	3	3	3	3	-	1	3	3	3	2	1	-
CO2	2	3	3	3	3	3	3	-	1	3	3	3	3	-	2
CO3	2	3	3	3	3	3	3	-	1	3	3	3	3	-	2
CO4	2	3	3	3	3	3	3	-	1	3	3	3	3	-	2
CO5	2	3	3	3	3	3	3	-	1	3	3	3	3	2	3
22PPC301	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**1**	**3**	**3**	**3**	**3**	**1**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1,1.3.1,1.4.1,2.2.2,2.2.3,2.2.4,3.1.1,3.1.5,3.2.1,3.2.3,4.1.1,4.1.2,4.1.3,4.2.1,4.3.1,4.3.4, 5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,9.2.1,9.3.1,10.1.1,10.1.2, 10.1.3,10.2.1,10.2.2,10.3.1,10.3.2,11.1.1,11.2.1,11.3.1,11.3.2,12.1.1,12.1.2,12.2.1,12.2.2, 12.3.1,12.3.2
CO2	1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3, 3.1.4,3.1.5,3.1.6,3.2.1,3.2.3,3.3.2,3.4.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.1,4.3.4,5.1.1,5.1.2, 5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,9.2.1,9.3.1,10.1.1,10.1.2,10.1.3, 10.2.1,10.2.2,10.3.1,10.3.2,11.1.1,11.2.1,11.3.1,12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2
CO3	1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3, 3.1.4,3.1.5,3.1.6,3.2.1,3.2.3,3.3.2,3.4.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.1,4.3.4,5.1.1,5.1.2, 5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,9.2.1,9.3.1,10.1.1,10.1.2,10.1.3, 10.2.1,10.2.2,10.3.1,10.3.2,11.1.1,11.2.1,11.3.1,12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2
CO4	1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3, 3.1.4,3.1.5,3.1.6,3.2.1,3.2.3,3.3.2,3.4.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.1,4.3.4,5.1.1,5.1.2, 5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,9.2.1,9.3.1,10.1.1,10.1.2,10.1.3, 10.2.1,10.2.2,10.3.1,10.3.2,11.1.1,11.2.1,11.3.1,12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2
CO5	1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3, 3.1.4,3.1.5,3.1.6,3.2.1,3.2.3,3.3.2,3.4.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.1,4.3.4,5.1.1,5.1.2, 5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,9.2.1,9.3.1,10.1.1,10.1.2,10.1.3, 10.2.1,10.2.2,10.3.1,10.3.2,11.1.1,11.2.1,11.3.1,12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2

ASSESSMENT PATTERN– THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	15	50	10	25	-	-	100
CAT2	15	68	17	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	40	50	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	40	10	-	-	100
ESE	15	60	25	-	-	-	100

22PPC302	ENGINEERING METALLURGY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
MATERIALS SCIENCE	PC	3	0	0	3

Course Objectives	*To study the phase diagrams, various heat treatment methods, principles of foundry, welding and powder metallurgy and to acquire knowledge on testing materials, properties and application of various methods.	
UNIT- I	**CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS**	**(9 Periods)**
Constitution of alloys – Solid solutions, substitutional and interstitial –phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide equilibrium diagram.		
UNIT- II	**HEAT TREATMENT AND SURFACE TREATMENT**	**(9 Periods)**
Definition – Full annealing, process annealing, stress relief, recrystallisation - spheroidizing – normalising, hardening and tempering of steels – austempering, martempering - Isothermal transformation diagrams – cooling curves superimposed on I.T diagram- CCR - hardenability, Jominy end quench test - Case hardening, carburising, nitriding, cyaniding, carbonitriding–Flame and Induction hardening.		
UNIT- III	**FERROUS AND NON FERROUS METALS**	**(9 Periods)**
Plain carbon steels – alloy steels - Effect of alloying elements (Mn, Si, Cr, Mo, V , Ni, Ti& W) on properties of steel - stainless and tool steels – Gray, White, Malleable, Spheroidal graphite - alloy cast irons – heat resistant steels and die steels. Copper, Aluminium, Nickel, Magnesium, Titanium, Lead, Tin - Important alloys - their composition, properties and applications - Material Specification and standards.		
UNIT- IV	**FOUNDRY AND POWDER METALLURGY**	**(9 Periods)**
Solidification of pure metals and alloys – melting – super heating – fluxing – micro and macro segregation – hot tears – heat transfer and structural change - Production of powders, mixing, blending, compacting, sintering and hot pressing – secondary operations- application of powder metallurgy – advantages and limitations.		
UNIT- V	**WELDING METALLURGY AND TESTING OF MATERIALS**	**(9 Periods)**
Weldability – heat distribution during welding and thermal effects on parent metals – HAZ – factors affecting HAZ - hardening, cracking, distortion and residual stresses – stress relief treatment of welds – Mechanical tests - tension, compression, impact, hardness, Non Destructive Testing basic principles and testing method for Radiographic testing, Ultrasonic testing, Magnetic Particle inspection and Liquid penetrant inspection test - Eddy current testing.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Higgins R.A **"Engineering Metallurgy"**, Viva books (p) ltd., 6th edition, 1998.*
2	*Dieter, G.E "**Mechanical metallurgy, SI metric edition**", McGraw-Hill, 1988.*
3	*Sydney H.Avner "**Introduction to Physical Metallurgy**", Tata McGraw Hill Book Company, 1994.*

REFERENCES:

1	*William D Callsber "**Material Science and Engineering**", Wiley India pvt Ltd 2007.*
2	*LakhtinYu."**Engineering Physical Metallurgy and Heat Treatment**", Mir Publisher,1985.*
3	*Kenneth G.Budinski and Michael K.Budinski "**Engineering Materials**", Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.*
4	*GUY.A.G "**Elements of Physical Metallurgy**", Oxford & IBH Pub.Co, 1990.*
5	*O.P.Khanna "**Material Science And Metallurgy**", Dhanpat Rai Publication, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Predict the alloy components and its composition variation with respect to temperature changes.	K3
CO2	Select suitable materials and heat treatment methods for various industrial applications.	K2
CO3	Explain various ferrous and nonferrous materials and their applications.	K2
CO4	Apply the knowledge of foundry and powder metallurgy to solve various industrial production processes	K3
CO5	Describe welding metallurgy and various Non-destructive testing methods to meet industrial requirements.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	-	-	-	-	1	3	2	1	3	-	-
CO2	2	2	2	3	-	-	-	-	1	3	2	1	3	-	-
CO3	2	2	2	3	-	-	-	-	1	3	1	1	3	-	-
CO4	2	2	2	3	-	-	-	-	1	3	2	1	3	-	-
CO5	2	2	2	3	-	-	-	-	1	3	2	1	3	-	-
22PPC302	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**1**	**3**	**2**	**1**	**3**	**-**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.2, 2.2.3, 2.2.4, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.3.1, 4.3.4, 9.2.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.3.1, 12.2.2, 12.3.1
CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.2, 2.2.3, 2.2.4, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.4, 9.2.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.3.1, 12.2.2, 12.3.1
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.2, 2.2.3, 2.2.4, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.4, 9.2.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.2.2, 12.3.1
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.4, 9.2.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.3.1, 12.2.2, 12.3.1
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.4, 9.2.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.3.1, 12.2.2, 12.3.1

ASSESSMENT PATTERN– THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	15	68	17	-	-	-	100
CAT2	15	52	33	-	-		100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	60	20	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	60	20	-	-	-	100
ESE	30	50	20	-	-	-	100

22PPC303	MANUFACTURING TECHNOLOGY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	*To enable the students to understand the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming, sheet metal and manufacture of plastic components.	
UNIT- I	**METAL CASTING PROCESSES**	**(9 Periods)**
Sand Casting : Sand Mould – Type of patterns – Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces : Blast and Cupola Furnaces; Principle of special casting processes : Shell – investment – Ceramic mould – Pressure die casting – Centrifugal Casting – CO_2 process – Stir casting; Defects in Sand casting.		
UNIT- II	**JOINING PROCESSES**	**(9 Periods)**
Operating principle, basic equipment, merits and applications of Fusion welding processes: Gas welding – Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding – Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of Resistance welding – Plasma arc welding –Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.		
UNIT- III	**METAL FORMING PROCESSES**	**(9 Periods)**
Hot working and cold working of metals – Forging processes – Open, impression and closed die forging– forging operations. Rolling of metals– Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.		
UNIT- IV	**SHEET METAL PROCESSES**	**(9 Periods)**
Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes-Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning– Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming.		
UNIT- V	**MANUFACTURE OF PLASTIC COMPONENTS**	**(9 Periods)**
Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – introduction to blow moulding – Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOK:

1	*HajraChouldhary S. K. and HajraChouldhary A. K.**"Elements of Workshop Technology -Volume I",** Media promoters and Publishers Private Limited, Mumbai, 2008.*
2	*Kalpakjian. S "**Manufacturing Engineering and Technology**", Pearson Education India Edition, 2018*

REFERENCES:

1	*Sharma, P.C., "**A TEXT BOOK of production Technology**", S.Chand and Co. Ltd., 2004.*
2	*P.N. Rao "**Manufacturing Technology Foundry, Forming and Welding**", TMH-2003; 2ndEdition, 2003.*
3	*Roy. A. Lindberg **"Processes and Materials of Manufacture",** PHI / Pearson Education, 2006*
4	*R.K. Rajput "**A Textbook of Manufacturing Technology (Manufacturing Processes)"**Laxmi Publications Limited, New Delhi, 2019.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe the fundamentals and different types of metal casting process.	K1, K2
CO2	Explain the different types and processes of metal joining process.	K4
CO3	Explain the concepts of metal forming processes.	K4
CO4	Describe various sheet metal forming processes.	K1, K2
CO5	Discuss different processes used in making plastic parts.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	1	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	-	1	-	2
CO4	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
22PPC303	**3**	-	-	-	-	-	-	-	-	-	-	-	**1**	-	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1; 14.1.1
CO2	1.3.1, 1.4.1; 14.1.1; 15.1.1
CO3	1.3.1, 1.4.1; 14.1.1; 15.1.1
CO4	1.3.1, 1.4.1; 14.1.1
CO5	1.3.1, 1.4.1; 14.1.1

ASSESSMENT PATTERN– THEORY

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	25	25	20	10	10	10	100
CAT2	25	25	20	10	10	10	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	25	25	20	10	10	10	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	25	25	20	10	10	10	100
ESE	25	25	20	10	10	10	100

22PMC3Z2	CONSTITUTION OF INDIA *(Common to all Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	MC	3	0	0	0

Course Objectives	*The objective of the course is to familiarize the students on the role, powers and functions of Indian government. Also understand the recent acts in India.	
UNIT- I	**INTRODUCTION AND EMERGENCY PROVISIONS**	**(9 Periods)**
Historical Background: The Company rule, The Crown rule - Constituent Assembly: Composition, Objectives - Preamble and Salient features of the Indian Constitution - Fundamental Rights, Fundamental Duties, Directive Principles of state policy, Emergency Provisions - National Emergency, President Rule, Financial Emergency.		
UNIT- II	**SYSTEM OF GOVERNMENT**	**(9 Periods)**
Parliamentary system: merits, demerits, reasons for adopting parliamentary system – Federal system: Evaluation of federal features –Centre-State relations: Legislative, Administrative and Financial relations – Local Government: Panchayati Raj and urban local government.		
UNIT- III	**UNION AND STATE GOVERNMENT**	**(9 Periods)**
President of India: Election, Powers and functions - Prime Minister and Cabinet: Structure and functions – Governor: Powers and functions - Chief Minister and Council of Ministers: Functions.		
UNIT- IV	**ORGANS OF GOVERNANCE AND RECENT ACTS**	**(9 Periods)**
Parliament: Lok Sabha and Rajya Sabha, Composition and powers - State Legislative Assembly and Legislative Council: Composition and powers - Judicial System in India: Structure and features - Supreme Court and High Court: Composition, Jurisdiction, Recent acts in significance-RTI, Citizenship act, POCSO act.		
UNIT- V	**POLITICAL DYNAMICS**	**(9 Periods)**
Political parties: Party system, Recognition of National and State parties – Elections: Electoral system and reforms – Pressure groups – National Integration: Obstacles, National Integration Council – Foreign Policy: Principles and Objectives.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Period**		

TEXT BOOK:

1	*National portal of India, "**The Constitution of India**" (Full Text), https://legislative.gov.in/constitution-of-india*
2	*Dr.B.R.Ambedkar, "**The Constitution of India**", SudhirPrakashan, 2020*

REFERENCES:

1	*Durga Das Basu, "**Introduction to the Constitution of India**, LexisNexis, 2022*
2	*P.M.Bakshi, "**The Constitution of India**", LexisNexis, 2020*
3	*Subash C Kashyap, "**Our Parliament**", National Book Trust, 2021*
4	*Subash C Kashyap, "**Our Political System**", National Book Trust, 2011*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Know the evolution of Indian Constitution and its basic premises.	K1
CO2	Explain the system of governance in India.	K2
CO3	Describe the structure of Union and State Governments	K2
CO4	Obtain the knowledge of functions of Legislature and Judiciary	K1
CO5	Know the political system of India	K1

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	1	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	-	1	2	-	-	-	-	-	-
CO5	-	-	-	-	-	2	-	2	1	-	-	-	-	-	-
22PMC3Z2	-	-	-	-	-	**2**	-	**1**	**1**	-	-	-	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2, 9.1.2
CO2	6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2, 9.1.2
CO3	6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2
CO4	6.1.1, 6.2.2, 9.1.2, 9.2.1
CO5	6.2.2, 8.1.1,8.2.2, 9.1.2, 9.2.1

ASSESSMENT PATTERN– THEORY

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	50	50	-	-	-	-	100
CAT2	50	50		-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	50	50	-	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	50	50	-	-	-	-	100
ESE	50	50	-	-	-	-	100

22PPC304	METALLURGY LABORATORY AND THERMAL SCIENCE LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

22PPC304	(A) METALLURGY LABORATORY

Course Objectives	*To impart the skill of micro structural examination, defect examination and heat treatment of ferrous and nonferrous materials.

LIST OF EXERCISES

1. Study of metallurgical microscope
2. Preparation of specimen for micro-examination
3. Study of Iron Carbon Equilibrium diagram
4. Study of microstructure of materials
   - -Steel (low carbon steel, high carbon steel, HSS, spheroidised steel)
   - -Cast iron (grey, white, SG)
   - -Non Ferrous (brass, aluminium, silicon alloy)
   - -Composites (MMC and PMC)
5. Study of Heat Treatment processes (Annealing, Normalizing, Hardening and Tempering)
6. Study of non-destructive tests
   - -Liquid penetrant test
   - -Ultrasonic inspection
   - -Magnetic particle inspection
   - -Radiography
7. Determination of Hardenability by Jominy end quench test.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 22.5 Periods Total: 22.5 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Prepare specimen for microscopic examination.	K2
CO2	Identify the microstructures of ferrous and nonferrous metals.	K3
CO3	Realize the effect of heat treatment on the properties of materials.	K3
CO4	Select suitable non-destructive tests for finding flaws in a material.	K3
CO5	Determine Hardenability by Jominy end quench test.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	3	1	1	-	1	-	-	1	-	1	-	2	1	1
CO2	2	3	1	1	-	1	-	-	1	-	1	-	2	1	1
CO3	2	1	-	1	-	1	1	-	1	-	1	-	2	1	1
CO4	3	2	1	1	-	1	-	-	1	-	1	-	2	1	1
CO5	3	2	1	1	-	1	-	-	1	-	1	-	2	1	1
22PPC304 (A)	**3**	**3**	**1**	**1**	**-**	**1**	**1**	**-**	**1**	**-**	**1**	**-**	**2**	**1**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1. 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 6.1.1, 6.2.1, 9.1.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 11.3.1
CO2	1.2.1. 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 6.1.1, 6.2.1, 9.1.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 11.3.1
CO3	1.2.1. 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 6.1.1, 6.2.1, 9.1.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 11.3.1
CO4	1.2.1. 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 6.1.1, 6.2.1, 9.1.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 11.3.1
CO5	1.2.1. 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 6.1.1, 6.2.1, 9.1.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 11.3.1

22PPC304	(B) THERMAL SCIENCE LABORATORY

Course Objectives	*To demonstrate and conduct performance test on internal combustion engines, compressors and blowers.

LIST OF EXERCISES

1. Valve timing diagram of single cylinder diesel engine.
2. Port timing diagram of single cylinder petrol engine.
3. Performance and heat balance test on 4 stroke diesel engine.
4. Economic speed test on diesel engine.
5. Retardation test to find frictional power of a diesel engine.
6. Performance test on constant speed blower.
7. Performance test on variable speed blower.
8. Performance test on reciprocating air compressor.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 22.5 Periods Total: 22.5 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Recognize how the valves on a diesel engine operate.	K2
CO2	Recognize how the ports in a gasoline engine operate.	K2
CO3	Analyze the performance characteristics of diesel engines.	K4
CO4	Evaluate the performance parameters of blowers.	K5
CO5	Analyze the air compressor characteristics.	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	3	2	2	3	-	-	2	-	1	1	2	1
CO2	2	2	1	3	2	2	3	-	-	2	-	1	1	2	1
CO3	3	3	3	3	3	2	3	-	2	3	2	2	1	2	1
CO4	3	3	3	3	3	2	3	-	1	3	2	1	1	2	1
CO5	3	3	3	3	3	2	3	-	2	3	2	2	1	2	1
22PPC304 (B)	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**-**	**1**	**3**	**2**	**2**	**1**	**2**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.4, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 5.1.1, 5.1.2, 5.3.2, 6.1.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 10.1.1, 10.1.2, 10.2.2, 10.3.1, 12.1.1, 12.2.1
CO2	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.4, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 5.1.1, 5.1.2, 5.3.2, 6.1.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 10.1.1, 10.1.2, 10.2.2, 10.3.1, 12.1.1, 12.2.1
CO3	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.4, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 5.1.1, 5.1.2, 5.3.2, 6.1.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.1.1, 9.2.1, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.2, 10.3.1, 11.1.1, 11.1.2, 11.2.1, 12.1.1, 12.2.1

CO4	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.4, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 5.1.1, 5.1.2, 5.3.2, 6.1.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.1.1, 9.2.1, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.2, 10.3.1, 11.1.1, 11.1.2, 11.2.1, 12.1.1, 12.2.1
CO5	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.4, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 5.1.1, 5.1.2, 5.3.2, 6.1.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.1.1, 9.2.1, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.2, 10.3.1, 11.1.1, 11.1.2, 11.2.1, 12.1.1, 12.2.1

22PPC305	MANUFACTURING PROCESSES LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	* To practice various machining operations in lathe, radial drilling, shaper, grinder and milling machine.

LIST OF EXERCISES

1. Study of construction details of different types of lathes and tools.
2. Study of various accessories used in lathe.
3. Study of different types of tools used in lathe and the measuring instruments.
4. Exercises on models using conventional Lathes:
   - Facing, Plain turning, Step turning and Parting
   - Groove cutting, Knurling and Chamfering.
   - Form turning and Taper turning
   - Thread cutting (Internal and external - V and Square)
5. V-Groove cutting in Shaping machine.
6. Drilling, Tapping using Radial drilling machine.
7. Surface grinding using Surface Grinder.
8. Spur Gear milling.
9. Helical Gear milling.
10. Gear shaping.
11. Gear hobbing.
12. Making hexagonal hole using Slotting machine.
13. Letter cutting in vertical Milling machine.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the constructional details of different types of lathe.	K2
CO2	Perform various lathe machining operations	K3
CO3	Set up machines like shaper, grinding and milling machine for various applications.	K3
CO4	Manufacture gears using forming and generating methods of gear manufacturing.	K4
CO5	Operate machines tools for various assembly and fabrication tasks and expose to time management.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	3	1	2	3	3	1	3	3	1	-
CO2	2	2	3	2	1	3	1	2	3	3	1	3	3	1	-
CO3	2	2	3	2	1	3	1	2	3	3	1	3	3	1	-
CO4	2	2	3	2	1	3	1	2	3	3	1	3	3	1	-
CO5	2	2	3	2	1	3	1	2	3	3	1	3	3	1	-
22PPC305	**2**	**2**	**3**	**2**	**1**	**3**	**1**	**2**	**3**	**3**	**1**	**3**	**3**	**1**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1. 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1, 7.1.2, 8.2.1, 8.2.2, 9.1.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2,10.3.1, 11.3.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO2	1.2.1. 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1, 7.1.2, 8.2.1, 8.2.2, 9.1.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2,10.3.1, 11.3.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO3	1.2.1. 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1, 7.1.2, 8.2.1, 8.2.2, 9.1.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2,10.3.1, 11.3.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO4	1.2.1. 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1, 7.1.2, 8.2.1, 8.2.2, 9.1.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2,10.3.1, 11.3.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO5	1.2.1. 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2,4.3.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1, 7.1.2, 8.2.1, 8.2.2, 9.1.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2,10.3.1, 11.3.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2

22PBS408	APPLIED PROBABILITY AND STATISTICS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

Course Objectives	*To provide students with the foundations of probabilistic and statistical methods and analysis techniques mostly used in various applications in engineering and science like modeling of processes and predictions based on processes.	
UNIT- I	**PROBABILITY AND RANDOM VARIABLES**	**(9+3Periods)**
Sample spaces–Events-Probability Axioms–Conditional Probability–Independent Events–Total Probability-Baye'stheorem. Random Variables**:** Distribution Functions–Expectation–Moments - Moment Generating Functions.		
UNIT- II	**PROBABILITY DISTRIBUTIONS**	**(9+3Periods)**
Discrete function: Binomial, Poisson, Geometric-Continuous function: Uniform, Exponential, Normal, Gamma, (Mean, Variance, Moment generating function and Simple problems)- Functions of random variables.		
UNIT- III	**JOINT PROBABILITY DISTRIBUTIONS**	**(9+3Periods)**
Two dimensional Discrete and Continuous random variable- Marginal and Conditional probability distribution functions- Independence- Covariance- Correlation.		
UNIT- IV	**TESTING OF HYPOTHESIS**	**(9+3Periods)**
Large samples: Tests for Mean and proportions– Small samples: Tests for Mean,Variance and Attributes using t, F, Chi–Square distribution.		
UNIT- V	**DESIGN OF EXPERIMENTS**	**(9+3Periods)**
One-way classification, two-way classification and Latin Square Design.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK:

1	*Veerarajan.T, "**Probability and Statistics, Random Processes and Queuing Theory and Queuing Networks**'', Second reprint 2016, McGraw Hill Education (India) Private Limited.*
2	*Shelton M.Ross, "**Introduction to Probability and Statistics for Engineers and Scientists**"Sixth edition, 2021, Elsevier.*

REFERENCES:

1	*Gupta S.C and Kapoor V.K, "**Fundamentals of Mathematical Statistic''**, Sultan Chand & Sons, New Delhi.Reprint 2015.*
2	*Gupta S.P, "**Statistical Methods**'', Sultan Chand & Sons, New Delhi.Reprint 2015.*
3	*Douglas C. Montgomery and George C. Runger, "**Applied Statistics and Probability for Engineers**'' (6th edition), 2016, John Wiley & Sons.*
4	*Hwei Hsu,"**Schaum's Outline of Probability, Random Variables and Random Processes**'', 2017, McGraw Hill Education.*
5	*Roy D Yates, "**Probability and Stochastic Processes a friendly introduction for Electrical and Computer engineers**", John Wiley & sons, third edition 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Obtain the concept of probability and the general discrete probability distribution function and continuous probability distribution function.	K3
CO2	Explain the some probability mass functions and probability density functions.	K3
CO3	Explicate the joint probability distributions for discrete and continuous random variables.	K3
CO4	Describe hypothesis testing in general and in practice.	K3
CO5	Interpret the F probability distribution as the number of groups and the sample size change. Conduct and interpret one-way, two-way and Latin square ANOVA.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	2	2	-	-	-	-	-	-	-	2	-	1	-
CO2	3	3	2	2	-	-	-	-	-	-	-	2	-	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	2	-	1	-
CO4	3	3	2	2	-	-	-	-	-	-	-	2	-	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	2	-	1	-
22PBS408	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-	**2**	-	**1**	-
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.1.2, 2.1.1, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 2.4.4, 12.2.1
CO2	1.1.1, 1.1.2, 2.1.1, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 2.4.4, 12.2.1
CO3	1.1.1, 1.1.2, 2.1.1, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 2.4.4, 12.2.1
CO4	1.1.1, 1.1.2, 2.1.1, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 2.4.4, 12.2.1
CO5	1.1.1, 1.1.2, 2.1.1, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 2.4.4, 12.2.1

ASSESSMENT PATTERN– THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	50	30	-	-	-	100
CAT2	20	50	30	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	50	30	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	50	30	-	-	-	100
ESE	20	50	30	-	-	-	100

22PPC406	FLUID MECHANICS AND MACHINERY *(Common to MECH & PRODN Branches)*	SEMESTERIV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	* To understand the Fluid properties, types of fluid flow, dimensional analysis and performance of pumps and turbines.	
UNIT- I	**FLUID PROPERTIES**	**(9 Periods)**
Units and Dimensions – Fluid properties – Density, Specific gravity, Viscosity, Surface tension, Capillarity, Compressibility and Bulk modulus – Pascal's Law – pressure measurements – manometers - Fluid statics - Total pressure and centre of pressure on submerged surfaces.		
UNIT- II	**FLUID KINEMATICS AND DYNAMICS**	**(9 Periods)**
Types of fluid flow and flow lines – control volume – continuity equation in one - dimension and three dimension – velocity potential and stream function - Energy equation – Euler and Bernoulli's equations – Applications of energy equations - Flow meters - Laminar and Turbulent flow through pipes –Hagen poisullie equation – Darcy Weisbach formula – Applications.		
UNIT- III	**DIMENSIONAL ANALYSIS**	**(9 Periods)**
Need for dimensional analysis – Dimensional Homogeneity – Rayleigh's and Buckingham methods of dimensional analysis –Problems. Model study and Similitude – scale effects and distorted model.		
UNIT- IV	**TURBINES**	**(9 Periods)**
Classification – construction, working principles and design of Pelton wheel, Francis and Kaplan Turbines - work done and efficiency - specific speed - operating characteristics - Governing of Turbines – Problems.		
UNIT- V	**PUMPS**	**(9 Periods)**
Classification of pumps - Centrifugal pump - working principle - work done and efficiency – Multistage pumps - Reciprocating pumps - work done and efficiency - negative slip - air vessels - indicator diagram – Problems.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*P.N.Modi and S.N.Seth, **"Hydraulics and Fluid Mechanics, Including Hydraulic Machines"**,StandardBookHouse,NewDelhi,2015.*
2	*R.K.Bansal, **"Fluid Mechanics and Hydraulic Machines"**, Laxmi Publications (P) Ltd., NewDelhi,2018.*

REFERENCES:

1	*SubramanyaK.,**"FlowinOpenchannels"**,TataMcGraw-HillPublishingCompany,2015.*
2	*S.Ramamurtham and R.Narayanan, **"Hydraulics Fluid Mechanics and Fluid Machines"** DhanpatRai Publishing Company(P)Limited, 2014.*
3	*R.K.Rajput,**"AText Book of Fluid Mechanics and Hydraulic Machines"**, S.Chandand Company, NewDelhi ,2015.*
4	*D.S.Kumar, **"Fluid Mechanics and Fluid Power Engineering"**, S.K.Kataria& Sons, NewDelhi,2012.*
5	*G.K.Batchelor, **"An Introduction to Fluid dynamics",** Cambridge University Press, June 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the fluid properties and its applications.	K4
CO2	Gain knowledge on fluid flows to solve practical problems	K4
CO3	Apply the concepts of dimensional analysis for fluid flow problems	K4
CO4	Analyze the performance of turbines and design of turbines.	K4
CO5	Analyze the performance of pumps and design of pumps.	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	2	1	-	1	-	-	-	-	-	-	-	-	-	2	1
CO2	2	1	-	1	-	-	-	-	-	-	-	-	-	2	1
CO3	2	1	-	1	-	-	-	-	-	-	-	-	-	2	1
CO4	2	1	1	3	-	-	-	-	-	-	-	-	-	2	1
CO5	2	1	1	3	-	-	-	-	-	-	-	-	-	2	1
22PPC406	**2**	**1**	**1**	**2**	-	-	-	-	-	-	-	-	-	**2**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.3.1, 2.4.1, 4.1.2
CO2	1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.3.1, 2.4.1, 4.1.2
CO3	1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.3.1, 4.1.2
CO4	1.1.1, 1.3.1,2.1.2,2.1.3, 2.3.2, 3.2.2, 3.4.2, 4.1.1, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.3
CO5	1.1.1, 1.3.1, 2.1.2, 2.1.3, 2.3.2, 3.2.2, 3.4.2, 4.1.1, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.3

ASSESSMENT PATTERN– THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	30	20	-	-	100
CAT2	20	30	30	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	30	30	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	30	30	20	-	-	100
ESE	20	30	30	20	-	-	100

22PPC407	MECHANICS OF MATERIALS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
ENGINEERING MECHANICS	PC	3	1	0	4

Course Objectives	*To understand the basic concepts of stress, strain, shear force, bending moment, deflection of beams under different loading conditions, theory of columns and applications of torsion.	
UNIT- I	**STRESS AND STRAIN**	**(9 + 3 Periods)**
Stress and strain at a point-Tension, compression, shear stresses - Hooke's law - Compound bars – lateral strain - Poisson's ratio -Volumetric strain - Bulk modulus - Relationship among elastic constants – stress strain diagrams for mild steel and cast iron-Ultimate stress - Yield stress-Factor of safety - Thermal stresses - Thin cylinders - Strain energy due to axial force - Resilience- Stress due to gradual load, suddenly applied load and Impact load.		
UNIT- II	**SHEAR FORCE AND BENDING MOMENT**	**(9 + 3 Periods)**
Beams – Types of Beams - Types of loads, supports - Shear force – Bending moment – sign convention - shear force and bending moment diagrams for cantilever, simply supported and over hanging beams with concentrated , uniformly distributed and uniformly varying load-Relationship between rate of loading, shear force, bending moment- Point of contra flexure.		
UNIT- III	**THEORY OF BENDING AND COMPLEX STRESSES**	**(9 + 3 Periods)**
Theory of bending-Bending equation-Section Modulus-Stress distribution at a cross section due to bending moment and shear force for cantilever, simply supported beams with point, UDL loads (Rectangular, circular, I & T sections only) -combined direct and bending stresses, Kernel of section (Rectangular, Circular Sections only). 2D State of stress - 2D Normal and shear stresses on any plane-Principal stresses and Principal planes-Principal Strains and direction-Mohr's circle of stress.		
UNIT- IV	**DEFLECTION OF BEAMS AND THEORY OF LONG COLUMNS**	**(9 + 3 Periods)**
Determinations of deflection curve – Relation between slope, deflection and radius of curvature – Slope and deflection of beam at any section by Double integration method and Macaulay's method - Concept of Conjugate beam method (Theory only)- Euler's theory of long Columns- Expression of crippling load for various end conditions-Effective length-Slenderness ratio-limitations of Euler equation - Rankine formula for columns.		
UNIT- V	**THEORY OF TORSION**	**(9 + 3 Periods)**
Torsion of shafts - Torsion equation - Polar modulus- Stresses in Solid and Hollow circular shafts - Torsional rigidity - Power transmitted by the shaft – Angle of Twist - Strain energy due to Torsion - Modulus of rupture – Torsional resilience – Combined bending and Torsion - Stresses in helical springs - Deflection of helical spring-Leaf springs.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK :

1	*Sadhu Singh **"Strength of Materials",** Khana Publishers, New Delhi, 2014.*
2	*R.K .Rajput **"Strength of Materials",** S. Chand & Company Ltd., New Delhi 2018.*

REFERENCES:

1	*Dr.B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain* ***"Mechanics of Materials",*** *Lakshmi Publications Pvt Ltd, New Delhi, 2002.*
2	*Kazimi,* ***"Solid Mechanics",*** *Tata McGraw Hill, New Delhi, 2001.*
3	*Robert L.Mott****"Applied Strength of Materials",*** *PHI Learning Pvt. Ltd, New Delhi, 2009.*
4	*Jindal U C,* ***"Textbook on Strength of Materials",*** *Asian Books Pvt. Ltd., 2007*
5	*Ramamrutham S and Narayan R* ***"Strength of Materials",****Dhanpat Rai and Sons, New Delhi, 2000.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the stress, strain and modulus for different materials.	K2
CO2	Describe the concept of shear force and bending moment diagrams of beams.	K3
CO3	Identify and calculate complex stresses in beams with different loading conditions.	K3
CO4	Find the deflection behaviour of beams and slender columns.	K3
CO5	Apply the concepts of torsion in shafts and springs.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	2	3	-	1	-	-	-	-	-	-	-	1	1	1	1
CO2	1	2	2	1	-	-	-	-	-	1	-	1	1	-	1
CO3	2	3	1	2	1	-	-	-	-	1	-	1	1	1	2
CO4	2	3	1	1	1	-	-	-	-	-	-	1	1	1	2
CO5	1	3	1	1	1	-	-	-	-	-	-	1	1	1	1
22PPC407	**2**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**1**	**1**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 4.1.2, 4.1.3, 4.2.1, 12.2.1, 12.2.2
CO2	1.3.1, 2.1.3, 2.2.1, 2.2.3, 2.4.1, 2.4.2, 2.4.3, 3.1.1, 3.1.3, 3.1.4, 3.1.6, 3.2.3, 3.3.1, 4.1.2, 4.3.3, 4.3.4, 10.1.2, 10.3.1, 12.2.1, 12.3.1
CO3	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.4, 3.2.2, 3.4.1, 4.1.2, 4.1.3, 4.2.1, 4.3.2, 4.3.3, 5.1.2, 5.2.1, 10.1.1, 10.2.2, 12.1.2, 12.3.2
CO4	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.1.5, 3.2.1, 4.1.2, 4.1.3, 4.3.1, 5.1.1, 5.1.2, 12.1.1, 12.2.2
CO5	1.3.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.5, 3.1.6, 3.4.1, 4.1.1, 4.2.1, 4.3.2, 5.1.2, 5.3.2, 12.1.1, 12.2.1

ASSESSMENT PATTERN– THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	40	30	-	-	-	100
CAT2	20	40	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	40	30	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	40	40	-	-	-	100
ESE	30	40	30	-	-	-	100

22PPC408	CNC TECHNOLOGY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
MACHINE TOOLS AND PROCESSES	PC	3	0	0	3

Course Objectives	*To enable the students to understand CNC machines constructional features, working and programming.	
UNIT- I	**INTRODUCTION TO CNC MACHINE TOOLS**	**(9 Periods)**
Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, types of control systems, CNC controllers, characteristics, interpolators, types of CNC Machines – turning centre, machining centre, grinding machine, Vertical turret lathe, turn – mill centre, EDM.		
UNIT- II	**STRUCTURE OF CNC MACHINE TOOL**	**(9 Periods)**
CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings.		
UNIT- III	**DRIVES AND CONTROLS**	**(9 Periods)**
Spindle drives, feed drives – stepper motor, servo principle, DC and AC servomotors, Linear motors. Open loop and closed loop control, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosyn, laser interferometer.		
UNIT- IV	**CNC PROGRAMMING**	**(9 Periods)**
Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre for Fanuc controller - Generation of CNC codes from CAM packages.		
UNIT- V	**TOOLING AND WORK HOLDING DEVICES**	**(9 Periods)**
Cutting tool materials for CNC machine tools – Carbides, Ceramics, CBN, PCD – inserts classification - qualified, semi qualified and preset tooling, tooling for Machining and Turning centre, ATC, APC, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*HMT Limited, "**Mechatronics**", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007*
2	*Mike Mattson, "**CNC Programming Principles and Applications**", Delmar Cengage learning, 2010*

REFERENCES:

1	*Evans K., Polywka J. and Stanley Gabrel., "**Programming of CNC Machines**", Third Edition – Industrial Press Inc, New York, 2007*

2	*Madison J., "**CNC Machining Hand Book**", Industrial Press Inc., 1996.*
3	*Smid P., "**CNC Programming Hand book**", Industrial Press Inc., 2007 Third Edition*
4	*Radhakrishnan P., "**Computer Numerical Control Machines**", New Central Book Agency, 2002.*
5	*Rao P.N., "**CAD/CAM Principles and Applications**", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe the evolution and principle of CNC machine tools and types of control systems.	K3
CO2	Apply knowledge in current terminology to describe the CNC machines and its types.	K3
CO3	Describe constructional features of CNC machine tools, drives and positional transducers used in CNC machine tools.	K3
CO4	Generate CNC programs for popular CNC controllers.	K6
CO5	Describe tooling and work holding devices for CNC machine tools.	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	2	1	1	2	2	3	1	-	1	3	-	1	1	-	-
CO2	2	1	1	2	3	3	1	-	1	3	1	1	1	-	-
CO3	2	1	1	2	3	3	1	-	1	3	1	1	2	-	-
CO4	2	1	1	-	2	-	-	-	1	3	-	2	-	3	-
CO5	2	1	1	-	2	3	3	1	1	3	2	1	2	-	-
22PPC408	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**1**	**1**	**3**	**1**	**2**	**2**	**1**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1, 1.3.1, 2.1.3, 2.2.3,2.2.4, 2.3.1, 3.1.4,3.1.5,3.1.6, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 5.1.1, 5.1.2, 5.3.1, 6.1.1, 6.2.1, 7.1.2, 9.2.1, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.2.2.
CO2	1.2.1, 1.3.1, 2.1.3, 2.2.3,2.2.4, 2.3.1, 3.1.4,3.1.5,3.1.6, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 7.1.2, 9.2.1, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.2.2.
CO3	1.2.1, 1.3.1, 2.1.3, 2.2.3,2.2.4, 2.3.1, 3.1.4,3.1.5,3.1.6, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 7.1.2, 9.2.1, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.2.2.
CO4	1.2.1, 1.3.1, 2.1.3, 2.2.3,2.2.4, 2.3.1, 3.1.4,3.1.5,3.1.6, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 9.2.1, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.2, 12.2.1, 12.2.2.
CO5	1.2.1, 1.3.1, 2.1.3, 2.2.3,2.2.4, 2.3.1, 3.1.4,3.1.5,3.1.6, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 9.2.1, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.2.1,11.3.1, 12.2.2.

ASSESSMENT PATTERN– THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	15	68	17	-	-	-	100
CAT2	15	52	-	-	-	33	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	40	40	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	-	-	-	100	100
ESE	9	59	16	-	-	16	100

22PPC409	**PROCESS PLANNING AND COST ESTIMATION** (*Common to MECH & PRODN Branches)*	**SEMESTER IV**

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	*To introduce the process planning concepts, cost estimation for various manufacturing process.	
UNIT- I	**INTRODUCTION TO PROCESS PLANNING**	**(9 Periods)**
Aims and Objectives, Place of process planning in Manufacturing cycle - Process and Production Planning. Drawing interpretation, Dimensional tolerance vs Production processes.		
UNIT- II	**PROCESS PLANNING STEPS**	**(9 Periods)**
Design of a process plan – Selection of production processes, tools and process parameters- Positioning and work holding devices, Selection of inspection devices and tools, Documenting the process plan. Computer-Aided Process Planning (CAPP) – Benefits, Architecture and approaches.		
UNIT- III	**INTRODUCTION TO COST ESTIMATION**	**(9 Periods)**
Importance, Types, Purpose, Components, Procedure, Classification of costs, Cost elements, Cost ladder, Overhead expenses, Break-even analysis - Concept, make or buy decision, assumptions, merits and demerits of breakeven analysis. Applications - Linear, multi product break-even analysis.		
UNIT- IV	**PRODUCT LIFE CYCLE MANGEMENT AND PRODUCTION COST ESTIMATION**	**(9 Periods)**
Product life cycle management - Estimation of production cost for - cast components, welded components, forged components, powder metallurgy parts.		
UNIT- V	**ESTIMATION OF MACHINING TIME AND COST**	**(9 Periods)**
Estimation of Machining time – Lathe operations, Drilling, Milling, Shaping, Planing and Grinding, Cost estimation for machining processes.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Panneerselvam, R. and Sivasankaran, P. "**Process Planning and Cost Estimation**", PHI Learning (P) Ltd., New Delhi, 2015.*
2	*Adithan, M. "**Process Planning and Cost Estimation**", New Age International (P) Ltd., Chennai, 2015.*

REFERENCES:

1	*Thomas E.Vollmann, "**Manufacturing Planning and Control Systems**", Galgotia Publications Pvt. Ltd., New Delhi, 1998.*
2	*Samuel Eilon, "**Elements of Production Planning and Control**", MacMillan, London, 1985.*
3	*Kesavan, R. Elanchezhian, C. and Vijayaramanath, B., "**Process Planning and Cost Estimation**",*

	New Age International (P) Ltd., Chennai, 2019.
4	*Narang, B.S. and Kumar, V., "**Production and Costing**", Khanna Publishers, 2014.*
5	*Banga,T.R. and Sharma, S.C., "**Mechanical Estimating and Costing**", Khanna Publishers, New Delhi, 2001.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Discuss the concept of process planning.	K2
CO2	Describe the steps involved in process planning.	K3
CO3	Discuss about cost estimation and Break Even analysis.	K3
CO4	Estimate the manufacturing cost for welded, forged components and powder metallurgy parts.	K4
CO5	Calculate the machining time and cost for various machining processes.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	-	-	-	-	-	-	-	-	1	-	1	2	-	-
CO2	2	1	-	-	2	-	-	-	-	1	-	1	2	1	-
CO3	2	3	-	-	-	-	-	-	-	-	2	1	2	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	1	2	-	-
CO5	2	3	-	-	-	-	-	-	-	-	-	1	2	-	-
22PPC409	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**2**	**1**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 10.1.1, 10.1.2, 12.2.1, 12.2.2
CO2	1.3.1, 1.4.1, 2.2.4, 5.1.1, 5.2.1, 5.3.1, 10.1.1, 10.1.2, 12.2.1, 12.2.2
CO3	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 11.1.1, 11.2.1, 12.2.1, 12.2.2
CO4	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 12.2.1, 12.2.2
CO5	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 12.2.1, 12.2.2

ASSESSMENT PATTERN– THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	15	68	17	-	-	-	100
CAT2	15	52	33	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	50	50		-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	50	-	-	-	100
ESE	9	43	48	-	-	-	100

22PES408	ENGINEERING EXPLORATION FOR PRODUCTION ENGINEERING	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objective	* To provide an introduction to the engineering field. It is designed to help the student to learn about engineering and how it is useful in our everyday life.	
UNIT-I	**INTRODUCTION**	**(15 Periods)**
Introduction to Engineering and Engineering study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, expectation for the 21st century engineer and Graduate Attributes.		
UNIT-II	**ENGINEERING DESIGN**	**(15 Periods)**
Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements, Problem definition, Idea generation through brain storming and researching, solution creation through evaluating and communicating, text/analysis, final solution and design improvement.		
UNIT-III	**ENGINEERING DISCIPLINES**	**(15 Periods)**
Types of motion, mechanical power system, mechanical power formula, mechanical design, etc.,		
Contact Periods: **Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**		

REFERENCES:

1	*Ryan A Brown, Joshua W. Brown and Michael Berkihiser: "**Engineering Fundamentals: Design, Principles, and Careers**", Goodheart-Willcox Publisher, Second edition, 2014.*
2	*Saeed Moaveni, "**Engineering Fundamentals: An Introducton to Engineering**", Cengage learning, Fourth Edition, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain technological and engineering development, changes and impacts of engineering	K2
CO2	Complete initial steps(Define a problem, list criteria and constraints, Brainstorm potential solutions and document ideas) in engineering designs	K3
CO3	Communicate possible solutions through drawings and prepare project report.	K3
CO4	Draw sketches to a Design problem.	K3
CO5	Apply the concept of engineering fundamentals in Production Engineering field.	K3

	a) CO and PO Mapping														
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	1	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
22PES408	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
	1 – Slight, 2 – Moderate, 3 – Substantial														
	b) CO and Key Performance Indicators Mapping														
CO1															
CO2															
CO3															
CO4															
CO5															

22PPC410	STRENGTH OF MATERIALS AND FLUID MACHINERY LABORATORY (Common to MECH & PRODN Branches)	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
ENGINEERING MECHANICS	PC	0	0	3	1.5

Course Objectives	* To understand the basics of different testing methods for different materials. * To study the behaviour of fluid system in pumps and turbines

22PPC410 (A) STRENGTH OF MATERIALS

LIST OF EXERCISES

1. Tension Test on steel rods using Universal Testing Machine.
2. Bending Test on rolled steel Joist Beam.
3. Double shear test on mild steel rod.
4. Torsion Test on Mild steel rod
5. Tension and Compression Test on Springs
6. Deflection test on simply supported aluminum beam
7. Deflection Test on Cantilever Beam
8. Hardness tests on metals like Mild Steel, Brass, Copper and Aluminum
9. Bend Test on Steel rod
10. Compression Test
11. Impact test-izod and charpy

22PPC410 (B) FLUID MACHINERY LABORATORY

LIST OF EXERCISES

1.Calibration of Venturimeter
2.Flow through Mouthpiece
3.Determination of Darcy's friction factor
4.Performance Study of Roto dynamic pumps: Centrifugal pump and Submersible pump
5. Performance Study of Positive displacement pumps: Reciprocating pump, Gear oil pump and Single screw pump.
6. Load test on Turbines: Pelton wheel, Francis turbine and Kaplan Turbine.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply knowledge of compression, tension, shear and torsion testing procedures on materials.	K3
CO2	Know the deflection and bending behavior of different types of beams.	K3
CO3	Find the hardness of different metals.	K3
CO4	Find the flow properties of fluids at different places.	K3
CO5	Conduct performance tests on pumps and turbines.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	-	1	-	1	-	1	-	2	1	1	-	1
CO2	1	-	1	-	1	-	-	-	-	-	2	1	1	-	1
CO3	1	-	1	-	-	-	-	-	1	-	-	1	1	-	1
CO4	-	1	-	2	1	-	1	-	-	-	-	-	-	2	1
CO5	-	1	-	2	1	-	1	-	-	-	-	-	-	2	1
22PPC410	**1**	**1**	**1**	**1**	**1**	-	**1**	-	**1**	-	**1**	**1**	**1**	**1**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 2.1.1, 2.1.2, 2.4.2, 2.4.4, 3.1.1, 3.1.4, 3.1.5, 3.2.2, 3.4.1, 3.4.2, 5.1.2, 5.2.1, 7.2.2, 9.1.2, 9.3.1, 11.1.1, 11.1.2, 12.1.2, 12.2.2
CO2	1.1.1, 3.1.1, 3.1.5, 3.1.6, 3.2.3, 5.3.1, 5.3.2, 11.1.1, 11.2.1, 12.1.1, 12.3.2
CO3	1.2.1, 3.1.3, 3.1.4, 3.1.6, 3.4.1, 9.3.1, 12.2.1, 12.3.1
CO4	2.1.2, 2.1.3, 2.3.1, 2.4.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 5.2.1, 5.3.2, 7.1.1
CO5	2.1.2, 2.1.3, 2.3.1, 2.4.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 5.2.1, 5.3.2, 7.1.1

22PPC411	PRODUCTION DRAWING	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
ENGINEERING GRAPHICS	PC	0	0	3	1.5

Course Objectives	*To provide hands on training on assembly drawings and impart knowledge on various types of machine parts & joints and to create knowledge about important features of assembled parts used in major engineering applications.	
UNIT- I	**CONVENTIONS, ABBREVIATIONS AND SYMBOLS**	**(3 Periods)**
Interrupted views- Partial views of symmetrical objects- Conventional representation of intersection curves- Square ends and openings, adjacent parts- Common machine elements.		
UNIT- II	**FITS AND TOLERANCES**	**(6 Periods)**
Description of tolerances and grades- Types of fits and their description- Shaft and hole basis systems- Selection of fits from standard tables- Fits for different applications- Examples- Geometrical tolerances- Surface finish conventions.		
UNIT- III	**PREPARATION OF ASSEMBLY DRAWINGS AND COMPONENT DRAWINGS**	**(36 Periods)**
Cotter joint, Knuckle joint, Flange coupling, Universal coupling, Foot step bearing, Plummer block, Connecting rod ends, Cross heads, Screw jack, Lathe tailstock, Stop valves, Non-return valve.		
Contact Periods: **Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Gopalakrishna K.R "**Machine Drawing in First Angle Projection**", Subhas Stores, Bangalore, 2017.*
2	*Bhatt.N.D "**Machine Drawing**", Charotar Publishing House Pvt. Ltd., 51st edition, 2022.*

REFERENCES:

1	*Gill, P.S. "**Text Book of Machine Drawing**", S.K.Kataria and Sons, Publishers and Distributors, Delhi, 2013.*
2	*PSG College of Technology "**Design Data Book**", KalikathirAchchagam, 2012.*
3	*Narayana, K.L., Kannaiah, P. and Venkata Reddy, K. "**Machine Drawing**", New Age International Publishers, 6th edition 2019.*
4	*Dr. Dahwan, R.K.,"**A Textbook of Machine Drawing**", S Chand & company Ltd., 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe the conventions in assembly drawing	K2
CO2	Discuss the Fits and Tolerances	K3
CO3	Explain the Geometric Dimensioning & Tolerancing	K3
CO4	Identify machining and surface finish symbols.	K2
CO5	Construct an assembly drawing of various machine units.	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	-	-	-	-	-	-	2	-	1	2	-	-
CO2	2	1	1	-	-	-	-	-	-	2	-	1	2	-	-
CO3	2	1	1	-	-	-	-	-	-	2	-	1	2	-	-
CO4	2	1	1	-	-	-	-	-	-	2	-	1	2	-	-
CO5	2	1	1	-	-	-	-	-	-	2	-	1	2	-	-
22PPC411	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**2**	**-**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.3.1, 2.3.2, 3.1.1, 3.1.2, 3.1.4, 3.1.6, 3.2.1, 3.3.1, 10.1.1, 10.1.2, 10.3.1, 10.3.2, 12.2.1, 12.2.2
CO2	1.1.1, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.3.1, 2.3.2, 3.1.1, 3.1.2, 3.1.4, 3.1.6, 3.2.1, 3.3.1, 10.1.1, 10.1.2, 10.3.1, 10.3.2, 12.2.1, 12.2.2
CO3	1.1.1, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.3.1, 2.3.2, 3.1.1, 3.1.2, 3.1.4, 3.1.6, 3.2.1, 3.3.1, 10.1.1, 10.1.2, 10.3.1, 10.3.2, 12.2.1, 12.2.2
CO4	1.1.1, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.3.1, 2.3.2, 3.1.1, 3.1.2, 3.1.4, 3.1.6, 3.2.1, 3.3.1, 10.1.1, 10.1.2, 10.3.1, 10.3.2, 12.2.1, 12.2.2
CO5	1.1.1, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.3.1, 2.3.2, 3.1.1, 3.1.2, 3.1.4, 3.1.6, 3.2.1, 3.3.1, 10.1.1, 10.1.2, 10.3.1, 10.3.2, 12.2.1, 12.2.2