IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Mechanical Engineering Department

B. Tech, IV Sem

Scheme

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem	Term work / Lab Work & Sessional		L	T	P	
1.	BSC – MA03	BSC	Probability and Statistics	60	25	15	-	-	100	2	1	-	3
2.	PCC-ME05	PCC	Machine Drawing	60	25	15			100	2	1	-	3
3.	PCC-ME06	PCC	Applied Thermodynamics	60	25	15			100	3	-	-	3
4.	PCC-ME07	PCC	Fluid Mechanics	60	25	15			100	3	1	-	4
5.	PCC-ME08	PCC	Kinematics of Machines	60	25	15			100	2	-	-	2
6.	HSMC-HS04	HSMC	Entrepreneurship & Principle of Management	60	25	15			100	1	-	-	1
7	IFC-EC01	IFC	Interdisciplinary Foundation Course	60	25	15			100	1	-	2	2
8	LC-ME06(P)	LC	Applied Thermodynamics Laboratory	-	-	-	60	40	100	-	-	2	1
9	LC-ME07(P)	LC	Fluid Mechanics Laboratory				60	40	100	-	-	2	1
10	LC-ME08(P)	LC	Kinematics of Machines Laboratory	-	-	-	60	40	100	-	-	2	1
11	SBC-ME03(P)	SBC	Drawing & Drafting Lab	-	-	-	60	40	100	-	-	2	1
12	MC-4	MC	Constitution of India	-	-	-	-	-	-	1	-	-	Audit
Total Academic Engagements and Credits										**15**	**3**	**10**	**22**
Total				**420**	**175**	**105**	**240**	**160**	**1100**	**15**	**3**	**10**	**22**

*MST: Minimum of two mid semester tests to be conducted.

L: Lecture T: Tutorial P: Practical

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Syllabus

BSC- MA03	**Probability and Statistics**	**2L:1T:0P (3 Hrs)**	**3 Credits**

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PCC-ME05	Machine Drawing	2L:1T :0P (03hrs)	Credits:03

Pre requisite(s): Engineering Graphics

Course Objective's:
Enable the students to prepare a detailed assembly drawing for machine components.

Course Content:

Module 1 **(10 hrs)**
Drawing conventions; drawing and dimensioning IS codes, sectional views and sectioning, representation of machine parts such as external and internal threads, slotted heads, square ends, and flat radial ribs, slotted shaft, splined shafts, bearings, springs, gears, surface finish and tolerances, Rivet heads and Riveted joints, types of welded joints and representation. Drawing of threaded fasteners.

Module 2 **(20 hrs)**
Assembly Machine Drawing, Basic concept of assembly drawing ,bill of materials, Assembly drawing of Cotter and Knuckle joints, pedestal and footstep bearings, Engine parts- crosshead and stuffing box, IC engines parts - piston and connecting rods; lathe machine parts-Tool post and Tail Stock.

Module 3 **(10 hrs)**
Basic design concepts, design process, stages/phases in design, flowchart, problem formulation, design considerations (strength, manufacturing, maintenance, environment, economics and safety); design for recycle and reuse, Design and safety factors for steady and variable loads, impact and fatigue considerations, reliability and optimization, standardization in design.

Module 4 **(10 hrs)**
Limits, Fit and Tolerances: Basics of Limits, Fit and Tolerances, Introduction, Importance, Conventions, concept of standardization and applications.

Course Outcomes:
After completion of this course, the students are able to:
1. Understand Indian standards for machine drawing.
2. Use drawing conventions for machine drawing.
3. Prepare assembly drawing of joints, couplings and machine elements.
4. Understand basic design concepts and considerations for machine design.
5. Conceptualize

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List of Text Book:

1. "Machine Drawing, N.D. Bhatt", "Charotar", "Edition of Year" .
2. "Machine Drawing, Singh A", "Charotar", "TMH"
3. "Machine Drawing, Narayana and Reddy", "New age, Delhi", "Edition of Year"
4. "Mechanical Engineering Design, Shigley JE et al", "TMH", "Edition of Year"
5. "Machine Design, Kulkarni SG", "TMH", "Edition of Year"
6. "Machine Design, Sharma PC, Agarwal DK", "Katson
7. "Design data book, PSG
8. "Mechanical design data book, Mahadevan and Reddy"

List of Reference Book:

1. "Machine Design, Mubeen and Mubeen",
2. "Design of Machine elements, Bhandari VB", "TMH".

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PCC-ME06	**Applied Thermodynamics**	**3L: 0T:0P (03 hrs)**	**Credits:03**

Course Objective's:
This course aims to provide a good platform to mechanical engineering students to apply basic knowledge of thermodynamics & concept of dynamics involved in thermal energy transformation.

Prerequisite (s): Thermodynamics

Module 1 **(08 hrs)**
Steam Generators: classification, conventional boilers, high-pressure boilers like Lamont, Benson, performance and rating of boilers, equivalent evaporation, boiler efficiency, heat balance sheet, combustion in boilers, super critical boilers, fuel and ash handling, boiler draught, overview of boiler codes.

Module 2 **(09 hrs)**
Phase Change Cycles: Vapor Carnot cycle and its limitation, Rankine cycle, effect of boiler and Condenser pressure and superheat on end moisture and efficiency of ranking cycle, modified Rankine cycle, reheat cycle, perfect regenerative cycle, Ideal and actual regenerative cycle with single and multiple heaters, open and closed type of feed water heaters, regenerative-reheat cycle, supercritical pressure and binary-vapor cycle, work done and efficiency calculations.

Module 3 **(10 hrs)**
Steam Turbines: impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum U.F Curtis stage, and Rateau stage, include qualitative analysis, effect of blade and nozzle losses on vane efficiency, stage efficiency, analysis for optimum efficiency, mass flow and blade height. Reactions staging: Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines, problem of radial equilibrium, free and forced vortex types of flow, flow with constant reaction, governing and performance characteristics of steam turbines.

Module 4 **(08 hrs)**
Air Compressors: Working of reciprocating compressor, work input for single stage compression different, compression processes, effect of clearance, volumetric efficiency real indicator diagram, isentropic & isothermal and mechanical efficiency, multistage compression, inter- cooling, condition for minimum work done, classification and working of rotary compressors.

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Module 5 **(10 hrs)**

Steam Condensers: Introduction, types of condensers, back pressure and its effect on plant performance air leakage and its effect on performance of condensers, various types of cooling towers, design of cooling towers.

Steam Nozzles: Steam Nozzles and their types, isentropic flow of vapors, flow of steam through nozzles, condition for maximum discharge, Effect of friction, super-saturated flow.

Course Outcomes:

After completion of this course, the students are able to:

1. Demonstrate the knowledge of operating characteristics of steam generator and their working performance.
2. Recognize the Rankine cycles and their types on pressure - volume and Temperature – Entropy diagram and evaluate their efficiencies.
3. Evaluate the performance of various steam turbines and their staging.
4. Explain the working of various types of air compressors and evaluate their performance.
5. Evaluate the Performance of steam condenser, steam nozzle and cooling towers.

List of Reference Book:

1. Nag PK; Power plant Engineering; TMH
2. Thermodynamics by Gordon J. Van Wylen
3. P.K.Nag; Basic and applied Thermodynamics; TMH
4. Mahesh M Rathore; Thermodynamics TMH
5. Ganesan; Gas turbines;TMH
6. Heat Engines by V.P. Vasandani& D. S.Kumar
7. R. Yadav Steam and Gas Turbines
8. Kadambi&Manohar;an Introduction to Energy Conversion–Vol II.Energy conversion cycles

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PCC-ME07	Fluid Mechanics	02L:01T:02P (03 hrs)	Credits: 03

Prerequisite(s): Basic Mechanical Engineering, Engineering Mathematics.

Course Objective's:

- To understand the fundamentals of fluid properties and to develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body.
- To be able to apply fundamental knowledge of fluid flow and behavior under various conditions.
- To understand different fluid flow principles and to deduct expression for energy and momentum equations.
- To develop and interpret for flow of fluids and solve fundamental pipe network problems.
- To be able to experiment with the behavior of fluid and boundary layer theory under various conditions.

Course Content:

Module 1 **(08 hrs)**

Introduction: Fluid and the continuum, fluid properties, surface tension, bulk modulus and thermodynamic properties, Newton's laws of viscosity and it's coefficients, Newtonian and non Newtonian fluids, hydrostatics and buoyancy, metacenter and metacentric height, stability of floating bodies.

Module 2 **(10 hrs)**

Fluid Kinematics: Langragian and Eularian method, description of fluid flow, stream line, path line and streak line, types of flow and types of motion, local and connective acceleration, continuity equation, potential flow, circulation, velocity potential, stream function, Laplace equation, flow nets.

Module 3 **(10 hrs)**

Fluid Dynamics: system and control volume, Reynold's transport theorem, Euler's equation, Bernoulli's equation & applications, momentum and moment of momentum equation, their applications, forces on immersed bodies, lift and drag,

Dimensional Analysis: Buckingham Pi and Rayleigh method, Kinematic and dynamic similarities and dimensionless numbers and their significance.

Module 4 **(08 hrs)**

Flow through Pipes: Reynold's number, laminar and turbulent flow, viscous flow through parallel plates and pipes, pressure gradient, head loss in turbulent flow (Darcy's equation), friction factor, minor losses, hydraulic and energy gradient, pipe networks. Basics of compressible fluid flow.

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Module 5 **(12 hrs)**

Boundary Layer Theory: Introduction

Turbulent Boundary Layer: Two-dimensional equation; Prandtl's mixing layer theory; Karman's hypothesis; Universal velocity distribution; flow over a flat plate; skin friction drag.

Thermal Boundary Layer: Two-dimensional equations; forced and natural convection over flat plate; natural convective flow over a vertical plate; effect of Prandt'l number.

Inertial Microfluidics: Fundamentals and applications of inertial microfluidics in different domains. Particle alignment/focusing on different micro-channel geometries innovations along with different parameters. Active and Passive sorting techniques for biomedical field and clinical research

Course Outcomes:

After completion of this course, the students are able to:

1. Define the fundamentals of fluid properties and to develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body.
2. To apply fundamental knowledge of fluid flow and behavior under various conditions.
3. Illustrate different fluid flow principles and to deduct expression for energy and momentum equations.
4. Develop and interpret for flow of fluids and solve fundamental pipe network problems.
5. Experiment with the behavior of fluid and boundary layer theory under various conditions.

List of Text Book:

1. Fluid Mechanics - Hydraulics & Hydraulic Machines, Modi & Seth, Standard Publications, New Delhi 2002.
2. Engineering Fluid Mechanics by K. L. Kumar, S. Chand & Co.2009

List of Reference Book:

1. Fluid Mechanics-Fundamentals &Applications ,Yunus A. Cengel& John M Cimbala, McGraw Hill,2007

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PCC-ME08	Kinematics of Machines	L: 2, T: 0, P: 0 (02 hrs)	Credits:02

Pre-requisite(s): Nil

Course Objective:
To expose the students to learn the fundamentals of various laws governing rigid bodies and its motions.

Course Content:

Module 1 **(12 hrs)**

Fundamentals of Kinematics and Mechanisms: Introduction, kinematics and kinetics, mechanisms and machines, degree of freedom, types of motions, kinematic concept of links, basic terminology and definitions, joints and kinematic chains, inversions, absolute and relative motions, displacement, velocity and acceleration diagrams, different mechanisms and applications.

Module 2 **(12 hrs)**

Velocity and Acceleration Analysis: Relative velocity acceleration methods, Corioli's component of acceleration, instantaneous center of Rotation method, Kennedy theorem of three center in line, body and space centrode, Klein's construction, kinematic synthesis of linkages, dynamic motion analysis of mechanisms and machines, D'Alembert's principle, number synthesis, free body diagrams, kinematic and dynamic quantities and their relationships, analytical method and graphical method.

Module 3 **(08 hrs)**

Theory of Gears: Gears, laws of gearing, classification and basic terminology, tooth profiles, kinematic considerations, fundamental law of toothed gearing, involute and cycloidal profile, conjugate action, contact ratio, minimum number of teeth, interference and under cutting. Helical gears: Nomenclatures, center distance, force analysis.

Module 4 **(08 hrs)**

Power Transmission and Gyroscope: Power transmission, kinematics of belt- pulley, flat and v –belt, rope, condition of maximum power transmission, efficiency,
Gyroscope: Introduction, Angular acceleration, gyroscopic couple, Effect of gyroscopic couple on aero plane, naval ship, Stability of vehicles.

Module 5 **(08 hrs)**

Cam and Followers: Cams, introduction, classifications of cams and followers, nomenclature, various cam profiles, analysis of cam and follower motion, analytical cam design with specific contours, pressure angle, radius and undercutting, motion constrains, critical path motion, torque on cam shaft.

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Course Outcome:

After completion of this course, the students are able to:

1. Explain the definitions of mechanism, machines, and able to calculate the degrees of freedom of a mechanism and machine.
2. Determine kinematic analysis (Velocity and acceleration) for a given of a given mechanism using analytically and graphically method.
3. Understand and recognize different types of gears with their field of application and working.
4. Understand and analyze the power transmission modes like belt, rope and chain drives and understand the gyroscopic action in machines.
5. Design cam according to desired motion.

List of Text Book:

1. R.L. Norton, kinematics& dynamics of machinery, Tata McGraw Hill, ISBN13 978 0 07 014480 4.
2. A. Ghosh & A. Malik, Theory of Mechanisms and Machines, EWP Pvt Ltd, ISB 81 85095 72 8.
3. Ballaney, P., "Theory if Machines and Mechanisms", 2005, ISBN 9788174091222 / 817409122X Khanna Publications.
4. Ratan S. S. "Theory of Machines", Tata McGraw Hills.

List of Reference Books:

1. Uicker Jr, J. J. , Penock G. R. and Shigley, J. E., "Theory of Machines and Mechanisms' 2003, Tata McGraw Hill.
2. Ramamurthy V., "Mechanisms of Machines", 3rd edition, ISBN 978-1842654569, Narosa Publishing House.
3. Bevan Thomas, "The Theory of Machines", 3rd edition, CBS publication.
4. Bansal, R. K., "Theory of machines", Laxmi Publications Pvt. Ltd, New Delhi
5. Ghosh Amitabha & Mallik Asok Kumar, "Theory of Mechanisms and Machines" east-West Press Pvt. Ltd. New Delhi
6. Kimbrell J.T., "Kinematics Analysis and Synthesis" McGraw – Hill International Editons.
7. Rao J.S. & Dukkipati R.V. , "Mechanisms and Machine Theory" New Age International Pvt. Ltd.

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LC-ME06(P)	**Applied Thermodynamics Laboratory**	**0L:0T :2P (02hrs)**	**Credits:01**

List of Experiment:

1. Study of Boiler draught and their classification.
2. Study of Subcritical boiler with demonstrate model.
3. Study of Supercritical boiler with demonstrate model.
4. Numerical Problem Based on Heat balance sheet for a Boiler.
5. To Determine the Volumetric efficiency of a single acting, double stage reciprocating air compressor.
6. To Determine the Nozzle coefficient of the given Nozzle meter.
7. To Determination of efficiency of condenser.
8. Numerical Problem Based on Steam Power Plant (Rankine Cycle).
9. Determination of airflow in duct and pipes.
10. Industrial Visit of Thermal power plant.

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LC-ME07(P)	**Fluid Mechanics Laboratory**	**0L:0T :2P (02hrs)**	**Credits:01**

List of Experiment:

1. To determine the Meta centric height.
2. To determine the co-efficient of discharge C_d for orifice meter and venturimeter.
3. To measure discharge through nozzle meter.
4. To study the losses due to friction in pipes.
5. To study the losses in pipe fitting sudden enlargement and sudden contraction.
6. To determine the Reynolds's number and the type of flow either laminar or turbulent flow.
7. To verify Bernoulli's Theorem.
8. To find the co-efficient of pitot tube.
9. To determine the coefficient of discharge through broad crested weir.
10. To study Viscosity, Velocity & Pressure measuring device.
11. Determine Coefficient of discharge, contraction & velocity of an Orifice.

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LC-ME08(P)	**Kinematics of Machines Laboratory**	**0L:0T :2P (02hrs)**	**Credits:01**

List of Experiment:

1. To study various types of kinematics links, pairs, chains & mechanisms.
2. To study different types of chains and their inversions.
3. To find the velocity and acceleration of various links/points in slider-crank Mechanism using Klein's construction method.
4. To measure the various parameters comprising the Corioli's component of acceleration.
5. To find out jump phenomenon of cam and follower with the help of test kit and to study various types of cams and followers arrangements.
6. To plot the n - θ (follower displacement vs. angle of cam rotation) curves for different cam follower pairs.
7. To study various kinds of belt drives.
8. To construct involute profile of a gear by generating method and to study various types of gear and gear trains.
9. Experimental justification of the equation $T = I_{\omega\omega} P$ for calculating the gyroscopic couple by observation and measurement of results for independent variation in applied couple C and angular velocity of precession ω_p.
10. To draw cam profile for various types of followers motion.

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SBC-ME03(P)	**Drawing & Drafting Lab**	**0L:0T :2P (02hrs)**	**Credits:01**

List of Experiment:

1. To draw the conventional symbols used in machine drawing.
2. To draw the orthographic projections of the given pictorial view of the mechanical components.
3. To assemble and draw full sectional Elevation, Plan and Bill of Material of Cotter joint.
4. To assemble and draw full sectional Elevation, Plan and Bill of Material of Knuckle joint.
5. To assemble and draw full sectional Elevation, Plan and Bill of Material of Foot-Step Bearing.
6. To assemble and draw full sectional Elevation, Plan and Bill of Material of Plummer Block.
7. To assemble and draw full sectional Elevation, Plan and Bill of Material of Cross Head.
8. To assemble and draw full sectional Elevation, Plan and Bill of Material of Stuffing Box.
9. To assemble and draw full sectional Elevation, Plan and Bill of Material of Connecting Rod.
10. To assemble and draw full sectional Elevation, Plan and Bill of Material of Tool Post.

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MLC02	Constitution of India	1L:0T:0P (1 Hrs)	Credits: 00

Course Objective:
The objective of this course is to familiarize the students with the feature of the Indian constitution, laws, democracy etc.

Course Content:

Module 1 **(06 hrs)**

Historical Background: Formation and working of constituent Assembly, Formation and working of Drafting committee, Commencement of Indian Constitution, Dr. Ambedkar's ideas of reservation in constitution

Module 2 **(05 hrs)**

Important Feature of the Constitution: Preamble, Fundamental Rights, Directive Principles of state policy, Fundamental Duties, Centre State Relation

Module 3 **(06 hrs)**

Parliamentary Democracy: Loksabha, Rajsabha Central Exclusive President, Prime minister, and Central Ministry, Vidhan Sabha, Vidhan Parishad and State Executive (Governor, Chief Minister, Minister of State)

Module 4 **(06 hrs)**

Special Provisions in Indian Constitution: Finance Commission Contingency Fund, Consolidated Fund, Public Service Commissions, Election Commission, Safeguards for S.C. S.T. and Backward Classes, Provisions for Emergency and Constitutional Amendments, Indian Judiciary Supreme court and High court

Suggested Reading

1. The Indian Constitution - Granville Austin
2. India's Constitution - M.V. Pylee, S. Chand Publication
3. Ambedkar and Constitution, Raj Kumar, Commonwealth Publication Pvt. Ltd., New Delhi,