COURSE STRUCTURE & DETAILED SYLLABUS

MECHANICAL ENGINEERING

B. TECH SECOND YEAR SECOND SEMESTER

(Applicable for the batches admitted from 2020-2021)

ACE

Engineering College

Ankushapur(V), Ghatkesar(M), Medchal Malkajgiri (Dist.), Telangana - 501 301.

(An Autonomous Institution, Affiliated to JNTUH ,Hyderabad)

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(Autonomous)

B.TECH. SECOND YEAR SECOND SEMESTER

MECHANICAL ENGINEERING

COURSE STRUCTURE

II Year				II Semester			
S.No.	Course Type	Course Code	Course Title	Periods Per Week			Credits
				L	T	P	
1	ESC	EE401ES	Principles of Electrical and Electronics Engineering	3	0	0	3
2	PCC	ME402PC	Kinematics of Machinery	3	1	0	4
3	PCC	ME403PC	Thermal Engineering – I	3	1	0	4
4	PCC	ME404PC	Fluid Mechanics and Hydraulic Machines	3	1	0	4
5	HSMC	SM405MS	Business Economics & Financial Analysis	3	0	0	3
6	PCC	ME406PC	Fluid Mechanics and Hydraulic Machines Lab	0	0	2	1
7	PCC	ME407PC	Thermal Engineering Lab	0	0	2	1
8	ESC	EE409ES	Principles of Electrical and Electronics Engineering Lab	0	0	2	1
9	*MC	MC409HS	Gender Sensitization Lab	0	0	2	0
10	*MC	MC410ME	CREO	0	0	2	0
Total				**15**	**3**	**10**	**21**

Note: *MC = Satisfactory/Unsatisfactory

R20 B.Tech ME II Year

ME402PC: KINEMATICS OF MACHINERY

B.Tech II year II semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Max Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ME402PC	**Core**	**3**	**1**	**0**	**4**	**30**	**70**	**100**
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: 0**				**Total Classes: 60**		
Prerequisite: Basic principles of Mechanics								

Course Objectives:

1. To understand the study of Kinematics concerned with relationship between geometry and motion of the parts of a machine and to understand the basic types of mechanisms and their inversions.
2. To impart skills to analyze the position, velocity and acceleration of various mechanisms.
3. To develop analytical competency in solving kinematic problems of mechanisms using different methods.
4. To understand and design cam mechanisms for specified output motions.
5. To understand the basic concepts of toothed gearing and kinematics of gear trains

Course Outcomes: Upon successful completion of the course, students will be able to:

1. Identify mechanisms in real life applications and perform kinematic analysis of simple mechanisms.
2. Analyze velocity and acceleration of mechanisms by vector and graphical methods.
3. Synthesize planar mechanisms for the given motion parameters using analytical and graphical methods.
4. Design cams and followers for specified motion profiles.
5. Evaluate the gear tooth geometry of different gear drives for motion/power transmission and analyses the different gear trains.

UNIT-I

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially, or successfully and incompletely constrained.

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially, or successfully and incompletely constrained.

Mechanism and Machines – Mobility of Mechanisms: Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

UNIT-II

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

Plane motion of body: Instantaneous center of rotation – centrodes and axodes–Three centers inline theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration

Analysis Synthesis of Mechanisms: Analysis of slider crank chain for displacement- velocity and acceleration of slider – Acceleration diagram for a given mechanism

UNIT-III

Straight-line motion mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism - Pantographs

Steering gears: Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.

Hooke's Joint: Single and double Hooke's joint –velocity ratio – application – problems

UNIT-IV

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of motion of followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

UNIT-V

Higher pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding.

Forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements – Introduction to Helical – Bevel and worm gearing

Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box - Differential gear for an automobile

Text Books :

1. Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/Oxford
2. Theory of Machines / S. S. Rattan / Mc Graw Hill Publishers Education McGraw-Hill Education, Reprint 2012

Reference Books:

1. Theory of Machines / Sadhu Singh / Pearson.
2. Theory of Machines / Thomas Bevan/CBS.

ME403PC: THERMAL ENGINEERING-I

B.Tech II year II semester

Course Code	Category	Hours/Week			Credits	Max Marks		
		L	T	P	C	CIA	SEE	Total
ME403PC	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: 0				Total Classes: 60		

Prerequisite: Thermodynamics

Course Objectives:

To apply the laws of Thermodynamics to analyze air standard cycles and to understand and evaluate the perform analysis of the major components and systems of IC engines, refrigeration cycles and their applications.

Course Outcomes:

At the end of the course, the student should be able to evaluate the performance of IC engines and compressors under the given operating conditions. Apply the laws of Thermodynamics to evaluate the performance of Refrigeration and air-conditioning cycles. Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance.

UNIT-I

I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry

UNIT-II

Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti-knock additives – combustion chamber – requirements, types of SI engines.

Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables

Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating.

UNIT-III

Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power–Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart

Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, undercooling, saving of work, minimum work condition for staged compression.

UNIT-IV

Rotary Compressor (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation–velocity triangles and energy transfer per stage degree of reaction, work done factor – isentropic efficiency – pressure rise calculations Polytropic efficiency.

UNIT-V

Gas Turbines: Simple Gas Turbine Plant – Ideal Cycle – Closed Cycle and Open Cycle for Gas Turbines, Constant Pressure Cycle, Constant Volume Cycle, Efficiency – Work Ratio and Optimum Pressure Ration for Simple Gas Turbine Cycle. Parameters of Performance, Actual Cycle, Regeneration,
Inter cooling and Reheating – Closed and Semi-Closed Cycle

Text Books :

1. I.C. Engines / V. Ganesan / Mc GrawHill
2. Thermal Engineering / Mahesh M Rathore / Mc GrawHill

Reference Books:

1. Applied Thermodynamics for Engineering Technologists / Eastop /Pearson
2. Fundamentals of Classical Thermodynamics / Vanwylen G.J., Sonntag R.E. / WileyEastern
3. Internal Combustion Engines Fundamentals – John B. Heywood – McGraw HillEd

ME404PC: FLUID MECHANICS AND HYDRAULIC MACHINES

B.Tech II year II semester

Course Code	Category	Hours/Week			Credits	Max Marks		
		L	T	P	C	CIA	SEE	Total
ME404PC	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: 0				Total Classes: 60		

Prerequisite: None

Course Objectives:

The objectives of the course are to enable the student.

- To understand the basic principles of fluid mechanics
- To identify various types of flows
- To understand boundary layer concepts and flow through pipes
- To evaluate the performance of hydraulic turbines
- To understand the functioning and characteristic curves of pumps

Course Outcomes:

- Able to explain the effect of fluid properties on a flow system.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design.
- To select and analyze an appropriate turbine with reference to given situation in powerplants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.
- Able to demonstrate boundary layer concepts.

UNIT-I

Fluid statics: Dimensions and units: physical properties of fluids-specific gravity, viscosity, and surface tension - vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers

UNIT-II

Fluid kinematics: Streamline, path line and streak lines and stream tube, classification of flows - steady & unsteady, uniform & non-uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three-dimensional flows.

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT-III

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel – total energy line – hydraulic gradient line. Measurement of flow: Pitot tube, venturi meter, and orifice meter, Flow nozzle

UNIT-IV

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine – working proportions, work done, efficiencies, hydraulic design – draft tube theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer

UNIT-V

Centrifugal pumps: Classification, working, work done – barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

Text Books :

1. Hydraulics, Fluid mechanics and Hydraulic Machinery - MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers
4. Fluid Mechanics Including Hydraulic Machines by A.K.Jain, Khanna Publishers, New Delhi, 8th Edition, 2003

ME406PC: FLUID MECHANICS AND HYDRAULIC MACHINES LAB

B.Tech. II Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ME406PC	**Core**	-	-	2	1	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 30**				**Total Classes: 30**		
Prerequisite: FMHM								

Course Objectives:

- To understand the basic principles of fluid mechanics.
- To identify various types of flows.
- To understand boundary layer concepts and flow through pipes.
- To evaluate the performance of hydraulic turbines.
- To understand the functioning and characteristic curves of pumps

Course Outcomes:

- Able to explain the effect of fluid properties on a flow system.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
- To select and analyze an appropriate turbine with reference to given situation in power plants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.
- Able to demonstrate boundary layer concepts

List of Experiments:

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturi meter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipeline.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli’s Theorems.

ME407PC: THERMAL ENGINEERING LAB

B.Tech. II Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ME407PC	**Core**	-	-	2	1	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 30**				**Total Classes: 30**		

Prerequisite: Thermodynamics & Thermal Engineering – I

Course Objectives:

- To understand the working principles of IC Engines, Compressors.

Course Outcomes:

List of Experiments:

1. I.C. Engines Valve / Port Timing Diagrams
2. I.C. Engines Performance Test for 4 Stroke SI engines
3. I.C. Engines Performance Test for 2 Stroke SI engines
4. I.C. Engines Morse, Retardation, Motoring Tests
5. I.C. Engine Heat Balance – CI/SI Engines
6. I.C. Engines Economical speed Test on a SI engine
7. I.C. Engines effect of A/F Ratio in a SI engine
8. Performance Test on Variable Compression Ratio Engine
9. IC engine Performance Test on a 4S CI Engine at constant speed
10. Volumetric efficiency of Air – Compressor Unit
11. Dis-assembly / Assembly of Engines
12. Study of Boilers

Note: Perform any 10 out of the 12 Exercises.

MC410ME: CREO

B.Tech. II Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
MC410ME	**MC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	2	1	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 30**				**Total Classes: 30**		

Prerequisite: NIL

Course Objectives:

- Develop skills to generate mechanical engineering drawings using CREO tools.
- To help Engineers in developing a product design virtually.

COURSE OUTCOMES

- Utilize the interface, Sketcher, Modeling enhancements in CREO Parametric.

List of Exercises:

1. Introduction to CREO parametric
2. 2D sketch modeling
3. 2D sketch Edit tools
4. 3D modeling
5. 3D modeling Advanced Features
6. Pattern Feature
7. 3D practice models
8. Surface modeling
9. Assembly modeling
10. Sheet metal modeling

REFERENCE BOOK:

1. PTC Creo Parametric 3.0 for Designers Book By Prof. Sham Tickoo CADCIM Technologies.