Tripura University
(A Central University)

Curriculum

For

B. Tech in Mechanical Engineering

(6th Semester)

2021

6th SEMESTER

Sl. No.	Course Category	Subject Code	Subject Title	L	T	P	Contact Hours/ week	Credit	Total Marks
1.	Program Core-21	PC ME 601	Fluid Power Engineering	3	0	0	3	3	100
2.	Program Core-22	PC ME 602	Mechanical Vibration	3	0	0	3	3	100
3.	Program Core-23	PC ME 603	Dynamics of Machine	3	0	0	3	3	100
4.	Program Core-24	PC ME 604	Refrigeration and Air Conditioning	3	0	0	3	3	100

5.	Program Core-25	PC ME 605	Mechanical Vibration & Dynamics of Machine Lab	0	0	2	2	1	100
6.	Program Core-26	PC ME 606	Fluid Machines Lab	0	0	2	2	1	100
7.	Program Core-27	PC ME 607	Refrigeration and Air Conditioning Lab	0	0	2	2	1	100
8.	Program Elective-1	PE ME 608/1	1.Internal Combustion Engines	3	0	0	3	3	100
		PE ME 608/2	2. Mechatronics Systems	3	0	0			100
		PE ME 608/3	3. Computer Aided Design	3	0	0			100
9.	Project - 1	PR ME 609	Mini Project	0	0	6	6	3	100
			Total :	15	0	12	27	**21**	**900**

FLUID POWER ENGINEERING

Course Code	PC ME-601
Course Title	Fluid Power Engineering
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Fluid Mechanics – I & II and Mathematics
Course Category	Program Core (PC)
Number of classes	36 hours

Course Outcome:

After completing this course, the students will be able to

CO Number	CO Description	K-level
CO-1	Explain the fundamentals behind the amount of force exertedby the impact of jets on different plates.	K2
CO-2	Calculate the problems related to hydraulic turbines.	K3
CO-3	Analyze basic principles related to hydraulic pumps.	K4
CO-4	Evaluate basic problems related to model testing of turbines, pumps and other hydraulic systems.	K5

Course Content:

Module 1: Impact of jets: (06 hours)

Classification of fluid mechanics. Impact of free jets – force, work done, efficiency on stationary and moving flat plates, hinged flat plates, stationary and moving curved vanes, Jet propulsion of ships. Classification of hydraulic turbines and hydraulic pumps.

Module 2: Hydraulic turbines: (10 hours)

Work done, power and efficiencies of Pelton turbines, Francis turbines, Kaplan turbine and Propeller turbine. Working proportion and design of Pelton wheel and Francis turbine runner. Draft tube, Cavitation, Performance characteristic of hydraulic turbine, Governing of hydraulic turbine, Surge tanks, specific speed, selection of turbines.

Module 3: Centrifugal and reciprocating pumps: (10 hours)

Centrifugal Pump --- main components, work-done, heads and efficiencies. Losses in centrifugal Pump, minimum starting speed, multistage pumps, specific speed, net positive suction head, cavitation, priming, selection of pumps, performance characteristics, operational difficulties of Centrifugal Pump, design consideration.

Reciprocating Pump --- main components, discharge, work-done, power, slip indication diagram, effect of friction and acceleration in suction and delivery pipes on indicator diagrams. Air Vessels, Centrifugal and axial flow compressors. Fans and blowers.

Module 4: Miscellaneous hydraulic systems: (10 hours)

Model studies – objectives and importance. Similitude, distorted models, model relationships of turbines, scale effect, Model testing of centrifugal pumps.

Other hydraulic systems – hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic lift, hydraulic ram, hydraulic coupling and torque converter. Air lift pump and Jet pump.

References / Suggested Learning Resources:

1. Som, S. K., & Biswas, G. Introduction to fluid mechanics and fluid machines: Tata McGraw-Hill.
2. Bansal, R. K. A textbook of fluid mechanics and hydraulic machines, Laxmi Pub.
3. Rajput, R.K., A Textbook of Fluid Mechanics and Fluid Machines, S. Chand Pub.
4. Kumar, D.S., Fluid Mechanics and Fluid Power Engineering, S.K.Kataria& Sons.
6. NPTEL courses: http://nptel.iitm.ac.in/courses.php - web and video resources on Fluid Mechanics.

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Mechanical Vibrations

Course Code	PC ME 602
Course Title	Mechanical Vibrations
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Theory of Machines
Course Category	Program Core (PC)
Number of classes	36 hours

Course Outcome: -

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

CO No	CO Description	K-level
CO-1	Solve the equations of motion for single DOF systemsof free vibration.	K3
CO-2	Formulate the equations of motion for single DOF systems of forced vibration.	K5
CO-3	Calculate the natural frequencies and mode shapes oftwo DOF systems.	K3
CO-4	Apply appropriate strategies for Vibration control.	K3

Course Content:-

Module 1*:* Single Degree of Freedom Systems-Free Vibrations: (9 hours)

Introduction to vibration, definitions and basic concepts, degree of freedom, types of vibrations, Undamped free vibrations, spring mass system, equivalent stiffness of spring combinations, longitudinal vibrations, transverse vibrations, torsional vibrations;Damped free vibrations, types of damping, free vibrations with viscous damping, logarithmic decrement, dry friction or coulomb damping.

Module 2:Single Degree of Freedom Systems-Forced Vibrations: (9 hours)

Forced vibrations with constant harmonic excitation, magnification factor, vibrations with rotating & reciprocating unbalance, vibrations due to excitation of the support, vibrations with coulomb damping.

Module 3:Two Degree of Freedom Systems: (9 hours)

Introduction, principal modes of vibration, spring mass coupled systems, double pendulum, torsional systems, systems with damping. Critical speed of a light shaft.

Module 4:Vibration Control: (9 hours)

Vibration isolation and transmissibility, force transmissibility, motion transmissibility, vibration absorbers, vibration measuring instruments, vibration control, vibration dampers and vibration isolators.

References/ Suggested Learning Resources: -

1. G. K. Grover," Mechanical Vibrations", Nemchand Publication, New Delhi
2. A. G. Ambekar, "Mechanical Vibrations and Noise Engineering, PHI, New Delhi
3. K.K. Purjara, Mechanical Vibrations, Dhanpat Rai and Sons, Delhi
4. V.P.Singh, Mechanical Vibrations Dhanpat Rai and Sons, Delhi
5. Debabrata Nag, Mechanical Vibration, John Wiley India
6. Thomson, Mechanical Vibration, Prentice Hall
7. Rao, S. S., "Mechanical Vibrations", 5th edition, Pearson Education
8. http://nptel.ac.in/courses/112103112/
9. http://nptel.ac.in/downloads/112104040

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Dynamics of Machines

Course Code	PC ME 603
Course Title	Dynamics of Machines
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Theory of Machines
Course Category	Program Core (PC)
Number of classes	36 hours

Course Outcome: -

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

CO No	CO Description	K-level
CO-1	Calculate static and dynamic forces of mechanisms.	K3

CO-2	Calculate the balancing masses and their locations of reciprocating and rotating masses.	K3
CO-3	Determine the speed and lift of the governor.	K6
CO-4	Estimate the Fluctuation of energy of the flywheel and the gyroscopic effect on body moves along a curved path.	K2

Course Content:-

Module 1*:* Force Analysis: (9 hours)
Force Analysis: Applied and constraint forces, Free body diagrams, Static equilibrium conditions, Static force analysis of simple mechanisms, Dynamic force analysis, Inertia force and Inertia torque, D Alembert's principle, Dynamic Analysis in reciprocating engines, Gas forces, Engine force analysis, Piston effort, Force along the connecting rod, Thrust on the sides of the cylinder, Crank effort, Thrust on the bearing, Turning moment on crank shaft.

Module 2:Balancing:(9 hours)
Balancing: Static and dynamic balancing,Balancing of rotating masses and reciprocating masses, Balancing a single cylinder engine, Balancing of Multi-cylinder inline, V-engines, Partial balancing in engines,Partial Balancing of Locomotives, Variation of Tractive Force, Swaying Couple, Hammer Blow.

Module 3:Governors: (9 hours)

Governors: Types, Porter, Proell, Hartnell, Centrifugal, Gravity controlled and spring controlled centrifugal governors & their characteristics, Effect of friction and inertia. Controlling force.

Module 4:Mechanism for Control: (9 hours)

Flywheel, Turning moment diagram for different types of engines, Fluctuation of energy and speed, Flywheel Rim dimension. Operation of flywheel in punching press. Gyroscopes, Gyroscopic forces and torques, Gyroscopic stabilization, Gyroscopic effects in Automobiles, ships and airplanes.

References/ Suggested Learning Resources: -

1. F. B. Sayyad, "Dynamics of Machinery", McMillan Publishers India Ltd., Tech-Max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, 2014.
3. Thomas Bevan, Theory of Machines, CBS Publishers and Distributors.
4. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw-Hill.
5. Ghosh. A and Mallick, A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd., New Delhi.
6. Rao.J.S. and Dukkipati.R.V. Mechanisms and Machine Theory, Wiley-Eastern Ltd., New Delhi.
7. V.Ramamurthi, Mechanics of Machines, Narosa Publishing House.
8. Khurmi, R.S., Theory of Machines, S Chand Publications

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Refrigeration and Air Conditioning

Course Code	PC ME 604

Course Title	Refrigeration and Air Conditioning
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Thermodynamics
Course Category	Program Core (PC)
Number of classes	38 hours

Course Outcome:

After completing this course, the students will be able to

CO Number	CO Description	K-level
CO-1	Apply principle of refrigeration for given system.	K3
CO-2	Select relevant refrigeration cycle for a given application.	K4
CO-3	Recommend refrigeration system components and refrigerants for given refrigeration system.	K5
CO-4	Calculate different air properties using psychrometric principle and different cooling load on given air conditioning system.	K3

Course Content:

Module 1: Introduction &Air refrigeration: (10 hours)

Definition andnecessity of refrigeration, refrigerating effect-unit of refrigeration-concept of COP, types of refrigeration-Ice, dry ice, Steam jet, throttling, liquid nitrogen refrigeration; thermodynamics of refrigeration, reversed Carnot cycle and its representation on P-V and T-S diagram, heat pump, limitations of reversed Carnot cycle, Bell - Coleman cycle, P-V & T-S diagram, air refrigeration system, component of air refrigeration system, its applications , advantage and disadvantages in air refrigeration.

Module 2: Vapour compression & Vapour absorptionrefrigeration systems: (10 hours)

Simple cycle, T- S and P- H diagrams, COP, effect of operating parameters on COP, methods of improving COP of simple cycle, super heating , under cooling, liquid suction heat exchanger, actual cycle, advanced vapour compression cycles, Ammonia –water system, simple system, drawbacks, lithium bromide water system, Electrolux refrigeration system , comparison with vapour compression system- steam jet refrigeration.

Module 3: Refrigeration System Components& Refrigerants: (08 hours)

Refrigeration Compressor-classifications, construction and working of hermitically sealed compressor, rotary compressors and applications, Condensers- classifications, working and applications, Evaporators-classifications, working and application,, Expansion device- classifications, selection, working and application. Refrigerants and their properties, eco-friendly refrigerants, mixed refrigerants, selection of refrigerants for different applications, Ozone depletion and global warming issues.

Module 4: Basics of Air conditioning&Air conditioning systems: (10 hours)

Air conditioning- necessity, types of air conditioning, principle of psychrometry, psychrometric processes, representation of processes on psychrometric chart, comfort air conditioning and cooling load calculations, summer and winter air conditioning, year around air conditioning, central air conditioning, room air

conditioners, split air conditioning systems, concept of air handling unit, air distribution system, air washers, cooling towers, evaporative condensers, cooling and dehumidifying coils, insulation, introduction to automobile air conditioning system.

References / Suggested Learning Resources:

1. Gosney, W.B, *Principles of Refrigeration*, Cambridge University Press, 1982.
2. Stoecker, W.F. and Jones, J.W., *Refrigeration and Air conditioning*, Tata McGraw Hill, 1986.
3. Arora, C.P., *Refrigeration and Air conditioning*, Tata McGraw Hill, 2nd Edition, 2000.
4. Kuehn, T.H., Ramsey, J.W. and Threlkeld, J.L., *Thermal Environmental Engineering*, 3rd Edition,Prentice Hall, 1998.
5. R J Dossat, *Principles of refrigeration,* John Wiley and sons Ltd.

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Mechanical Vibration and Dynamics of Machine Lab

Course Code	PCME 605
Course Title	Mechanical Vibration and Dynamics of Machine Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Mechanical Vibration, Dynamics of Machine
Course Category	Program Core (PC)
Number of classes	20 hours

Course Outcome:-

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

CO No	CO Description	K-level
CO-1	Justify the relation of simple pendulum.	K6
CO-2	Determine the radius of gyration and frequency of different vibration system.	K3
CO-3	Experiment and draw the characteristics curves of different types of governors.	K3
CO-4	Demonstrate the effect of whirling of shaft and static and dynamic balancing system.	K3

List of Experiments*(Minimum 6experiments to be performed).*

1. To Verify the relation of simple pendulum.
2. To determine the radius of gyration K of a given compound pendulum.
3. To determine the radius of gyration K of given bar using bi-filer suspension.
4. To study the longitudinal vibration of helical spring and to determine the frequency of oscillation theoretically and actually by experiment.
5. To study the Watt Governor and draw the characteristics curve.
6. To study the Porter Governor and draw the characteristics curve.
7. To study the Proell Governor and draw the characteristics curve.

8. To study the Hartnell Governor and draw the characteristics curve.
9. To study the effect of whirling of shaft.
10. To study the static and dynamic balancing system

References/ Suggested Learning Resources: -

10. 1. G. K. Grover," Mechanical Vibrations", Nem chand Publication, New Delhi
11. A. G. Ambekar, "Mechanical Vibrations and Noise Engineering, PHI, New Delhi
12. K.K. Purjara, Mechanical Vibrations, Dhanpat Rai and Sons, Delhi
13. V.P.Singh, Mechanical Vibrations Dhanpat Rai and Sons, Delhi
14. Debabrata Nag, Mechanical Vibration, John Wiley India
15. F. B. Sayyad, "Dynamics of Machinery", McMillan Publishers India Ltd., Tech-Max Educational resources, 2011.
16. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, 2014.
17. Rao.J.S. and Dukkipati.R.V. Mechanisms and Machine Theory, Wiley-Eastern Ltd., New Delhi.
18. V.Ramamurthi, Mechanics of Machines, Narosa Publishing House.
19. Khurmi, R.S., Theory of Machines, S Chand Publications

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Fluid Machines Lab

Course Code	PCME-606
Course Title	Fluid Machines Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Fluid Machines
Course Category	Program Core (PC)
Number of classes	20 hours

Course Outcome:

After completing this course, the students will be able to

CO Number	CO Description	K-level
CO-1	Explain the procedure forcollecting data to find out the hydraulic force of water jet on vanes.	K2
CO-2	Calculate the collected data to find out the efficiency of turbines.	K3
CO-3	Find out the overall efficiency of pump.	K3
CO-4	Analyze collected data to find out the efficiency of compressors.	K4

Course Content:

List of experiments:*(Minimum 6 experiments to be performed)*

1. Study the impact of jet on Vanes.
2. Study the Performance characteristics of Pelton Turbines.
3. Study the Performance characteristics of Francis Turbines.
4. Study the Performance characteristics of Kaplan Turbines.

5. Study the characteristics of centrifugal pumps.
6. Study the characteristics of reciprocating pumps.
7. Study the characteristics of two stage air compressors.
8. Study the characteristics Rotary air compressors.

References / Suggested Learning Resources:

1. Desmukh, T S, Fluid Mechanics and Hydraulic Machines A Lab Manual.
2. Lab manuals available in the laboratory.

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Refrigeration and Air Conditioning Lab

Course Code	PC ME 607
Course Title	Refrigeration and Air Conditioning Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Refrigeration and Air Conditioning
Course Category	Program Core (PC)
Number of classes	24 hours

Course Outcome:

After completing this course, the students will be able to

CO Number	CO Description	K-level
CO-1	Implement refrigeration cycles inrefrigeration system.	K3
CO-2	Evaluate performance of Vapour compression refrigeration system and Vapour absorption refrigeration system.	K5
CO-3	Analyze different psychrometric processes on general cycle air conditioning trainer.	K4
CO-4	Perform in split air-conditioner and window air-conditioner.	K3

Course Content:

List of experiments ***(Minimum6 experiments to be performed)***

1. Demonstration of Vapour compression refrigeration system and Vapour absorption refrigeration system.
2. Determination of the COP of Vapour compression refrigeration system.
3. Demonstration of the COP of Vapour absorption refrigeration system.
4. Study of domestic refrigerator and to determine % running time at different thermostat settings.
5. Study the working principle of steam jet refrigeration system.
6. Study of different psychrometric terms and processes
7. To understand construction and working of window air-conditioner/ split air-conditioner and to determine its capacity
8. Determine the COP, tonnage capacity and current consumption of an Ice plant
9. Design of Air Conditioning System and load calculation for residential and commercial buildings.

10. Study of measurement devices of all experimental setups used in RAC laboratory.

References / Suggested Learning Resources:

1. Gosney, W.B, *Principles of Refrigeration*, Cambridge University Press, 1982.
2. Stoecker, W.F. and Jones, J.W., *Refrigeration and Air conditioning*, Tata McGraw Hill, 1986.
3. Arora, C.P., *Refrigeration and Air conditioning*, Tata McGraw Hill, 2nd Edition, 2000.
4. Kuehn, T.H., Ramsey, J.W. and Threlkeld, J.L., *Thermal Environmental Engineering*, 3rd Edition,Prentice Hall, 1998.
5. R J Dossat, *Principles of refrigeration,* John Wiley and sons Ltd.

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Internal Combustion Engines

Course Code	**PE ME 608/1**
Course Title	Internal Combustion Engines
Number of Credits	**3 (L: 3, T: 0, P: 0)**
Prerequisites	**Nil**
Course Category	Program Elective (PE)
Number of classes	**36 hours**

Course Outcome:

	At the end of the course, the student will be able to:	
CO1	Explain the fundamentals of IC Engine	K2
CO2	Illustrate different modes of fuel supply system in SI and CI engine.	K3
CO3	Practice use of appropriate grade of lubricating oil and coolant.	K3
CO4	Measure the vital engine parameter.	K4

Course Content:

Module 1: Basic Cycles and Combustion(10 hours)

Review of ideal cycles; Details of fuel-air cycles. Basic components and terminology of IC engines, working of four stroke/two stroke - petrol/diesel engine, classification and application of IC engines, engine. Combustion in SI and CIengines, Combustion stages, Combustion chambers and Abnormal combustion. **Supercharging**: Need for supercharging, Effect of supercharging, types of supercharger,

Module 2: Fuels supply and Ignition System(10 hours)

Important qualities of IC engine fuels, rating of fuels**,** Carburation, mixture requirement for different loads and speeds, simple carburetor and its working, types of carburetors, MPFI, types of injection systems in CI engine, fuel pumps and injectors, types of nozzles, spray formation.
Ignition System: Battery and magneto ignition system, spark plug, firing order,

Module 3: Engine Lubrication and Cooling: (08 hours)

Engine Lubrication and Cooling: Lubrication of engine components, Lubrication system – wet sump and dry sump, crankcase ventilation, Types of cooling systems – liquid and air cooled, comparison of liquid and air-cooled systems.

Module 4:Testing of IC Engine and Emission control: (08 hours)

Measurement of indicated power, brake power, fuel consumption and emission, Measurement of friction power.Air pollution due to IC engines, emission norms, HC, CO and NOx emission, catalytic convertor. Advanced IC Engine concepts.

References / Suggested Learning Resources:

1. Obert E. F, "Internal Combustion Engines and Air Pollution", Harper and Row Publication Inc. NY, 1973.
2. Heisler H, "Advanced Engine Technology", Edward Arnold, 1995.
3. Heywood J. B, "Internal Combustion Engine Fundamentals", McGraw Hill Book Co. NY, 1989
4. Heldt P. M, "High Speed Combustion Engines", Oxford & IBH publishing Co. India, 1985.
5. Stockel M W, Stockel T S and Johanson C, "Auto Fundamentals", The Goodheart, Wilcox Co. Inc., Illinois, 1996.

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Mechatronic Systems

Course Code	PE ME 608/2
Course Title	Mechatronic Systems
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	Program Elective (PE)
Number of classes	36 hours

Course Outcome:

After completing this course, the students will be able to

CO Number	CO Description	K-level
CO-1	Select sensors and transducers to develop mechatronic systems.	K1
CO-2	Analyze automatic control and real time control systemswith the help of drives and actuators.	K4
CO-3	Explain the concept of smart materials.	K2
CO-4	Compare micromechatronic systemsthrough case studies.	K4

Course Content:

Module 1: Introduction & Sensors: (10 hours)

Definition of Mechanical Systems, Philosophy and approach; Systems and Design:Mechatronic approach, Integrated Product Design, Modeling, Analysis and Simulation, Man-Machine Interface;
Sensors and transducers: classification, Development in Transducer technology, Opto-electronics- Shaft encoders, CD Sensors, Vision System, etc.

Module 2: Drives and Actuators: (10 hours)

Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor andStepper motor, Drive circuits, open and closed loop control; Embedded Systems: Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems;

Module 3: Smart Materials: (06 hours)
Shape Memory Alloy, Piezoelectric and Magnetostrictive Actuators: Materials,Static and dynamic characteristics, illustrative examples for positioning, vibration isolation, etc

Module 4: Micromechatronic Systems: (10 hours)

Microsensors, Microactuators; Micro-fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology.

References / Suggested Learning Resources:
1) Mechatronics System Design, Devdas Shetty & Richard A. Kolk, PWS Publishing Company(Thomson Learning Inc.)
2) Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education
3) A Textbook of Mechatronics ,R.K.Rajput, S. Chand & Company Private Limited
4) Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall
5. Mechatronics – M.D.Singh & Joshi, Prentice Hall of India.
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Computer Aided Design

Course Code	PE ME 608/3
Course Title	Computer Aided Design
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Engineering Graphics and Design
Course Category	Program Elective (PE)
Number of classes	36 hours

Course Outcome:
After completing this course, the students will be able to

CO Number	CO Description	K-level
CO-1	Apprehend CAD system architecture.	K2
CO-2	Apply Geometric Modeling.	K3
CO-3	Animate engineering models.	K5
CO-4	Employ CAD standards.	K4

Course Content:
Module 1: Fundamentals of Computer Graphics:(10 hours)
Fundamentals of Computer Graphics- Product cycle, sequential and concurrent engineering, Computer Aided Design, CAD system architecture, computer graphics, Coordinate systems, 2D and 3D transformations, viewing transformation

Module 2: Geometric Modeling :(10 hours)

Geometric Modeling- representation of curves, Hermite curves, Bezier curves, B-spline curves, rational curves, Techniques of surface modelling, surface patch, Coons and bicubic patches, Bezier and B-spline surfaces, Solid modelling techniques, CSG and B-rep.

Module 3: Visual realism: (8 hours)
Visual realism- hidden line-surface-solid removal algorithms, shading, colouring, computer animation.

Module 4: Assembly modelling and CAD standards: (8 hours)

Assembly of parts- assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations, mechanism simulation and interefence checking CAD standards- Graphical Kernel System (GKS), standards for vexchange images, Open Graphics Library (OpenGL), Data exchange standards- IGES, STEP, CALS etc., Communication standards

References / Suggested Learning Resources:

1. 1. Ibrahim Zeid, Mastering CAD CAM, Tata McGraw Hill Publishing Co. 2007.
2. C. McMohan and J. Browne, CAD/CAM Principles, II edition, Pearson Education, 1999.
3. W. M. Neumann and R.F. Sproul, Principles of Computer Gra[hics, McGraw Hill, 1989. 4. D. Hearn and M.P> Baker, Computer Graphics, Prentice Hall Inc., 1992.

Mini Project

Course Code	PR ME 609
Course Title	Mini Project
Number of Credits	3 (L: 0, T: 0, P: 6)
Prerequisites	Nil
Course Category	Project (PR)
Number of classes	70 hours

Course Outcome:- After completion of the course, students will be able to:

CO Number	CO Description	K-level
CO-1	Demonstrate a through and systematic understanding of project contents	K-2
CO-2	Identify the methodologies and professional way of documentation and communication	K-3
CO-3	Illustrate the key stages in development of the project	K-2
CO-4	Develop the skill of working in a Team	K-3
CO-5	Apply the idea of mini project for developing systematic work plan in major project	K-3

Course Content:-

The mini project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The course should have the following-

1) Perform detailed study about various components of a project.
2) Study about methodologies and professional way of documentation and communication related to project work.
3) Develop idea about problem formulation.
4) Knowledge of how to organize, scope, plan, do and act within a project thesis.
5) Familiarity with specific tools (i.e. hardware equipment and software) relevant to the project selected.
6) Demonstrate the implementation of a mini project work.

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