



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (MECHANICAL ENGINEERING)

THIRD YEAR

Semester – V

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credit
B.E. ME	DYNAMICS OF MACHINERY	ME- 5011	3L-1T-2P	4

Course Outcomes: After studying this course, students will be able to,

CO1-The students will get competency in graphical and analytical method for solving problems in static and dynamic force analysis.

CO2-The students will get competency in conducting laboratory experiments for finding moment of inertia of rigid bodies, verification of displacement relation for Hokes joints, to measure power transmitted and absorbed by dy0mometer and brakes respectively.

CO3-The students will be able to understand working principles of various types of brakes, clutches and dynamometers.

CO4-This subject will help students to apply knowledge in the field of automobile, aerospace and Novel industries, where mechanisms and moving members force and kinematic analysis and Power transmitting elements play vital role.

UNIT - I

FORCE ANALYSIS –

Rigid body dynamics in general plane equation-Equations of motion-Dynamic force analysis-Inertia force and inertia torque-D’Alemberts principle-The principle of superposition-Dynamic analysis in reciprocating engines-Gas forces-Equivalent masses-Bearing loads-Crank shaft torque-Turning moment diagrams-Fly wheels-Engine shaking forces-Cam dynamics-Unbalance, Spring, Surge and Windup.

UNIT - II

MECHANISMS FOR CONTROL : Governors-Types-Centrifugal governors-Gravity controlled and spring controlled centrifugal governors-Characteristics-Effects of friction-Controlling force-Other governor machanisms. Gyroscopes-Gyroscopic forces and torques-Gyroscopic stabilization-Gyroscopic effects in automobiles, ships and airplanes.

UNIT - III

BALANCING- Static and dynamic balancing-Balancing of rotating masses-Balancing a single cylinder engine- Balancing multi- cylinder engines-Partial balancing in locomotive engines- Balancing linkages- Balancing machines.

UNIT - IV

FRICITION: Frictional torque in pivots and collars by uniform pressure and uniform wear rate criteria. Boundary and fluid film lubrication, friction in journal and thrust bearings, concept of friction circle and axis, rolling friction.

Clutches: Single plate and multi plate clutches, Cone clutches.

UNIT - V

BELT DRIVES: Velocity ratio, limiting ratio of tension; power transmitted; centrifugal effect on belts, maximum power transmitted by belt, initial tension, creep; chain and rope drives;

Brakes: Band brake, block brakes, Internal and external shoe brakes, braking of vehicles. Dynamometer: Different types and their applications.

Dynamic Analysis of Cams: Response of un-damped cam mechanism (analytical method), follower response analysis by phase-plane method, jump and cross-over shock.



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Text Book/References Books/ Websites

1. SS Rattan; Theory of machines; TMH
2. AG Ambekar; Mechanism and Machine Theory; PHI.
3. CS Sharma; Purohit K; Theory of Mechanism and Machines; PHI
4. Thomas Bevan; Theory of Machines; Pearson/ CBS PUB Delhi.
5. Ghosh and Mallick, theory of machine & mechanism
6. T. V. Ramachandra; Management of Municipal Solid Waste; TERI press.

Suggested List of Laboratory Practical (Expandable):

1. To study of inversion of single and double slider crank mechanism.
2. To study various types of kinematics links, pair, chains & mechanisms.
3. To study of simple four bar linkage mechanism
4. To study of various types of gears
5. To study of various types of gear trains.
6. To study of various types of Cam & follower arrangements.
7. To study of different types of belts.
8. To find the co-efficient of friction between wooden block and glass surface with horizontal surfaces.
9. To find the co-efficient of friction between wooden block and glass surface with inclined surfaces.



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Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credit
B.E. ME	FLUID MECHANICS	ME- 5021	3L-1T-2P	4

Course Outcomes: After studying this course, students will be able to,

CO 1-Use of various properties in solving the problems in fluids.

CO 2-Use of Bernoulli's equation for solutions in fluids.

CO 3-Determination of forces drag and lift on immersed bodies.

CO 4-Analyze the performance of hydraulic machines.

CO 5-Analyze the performance of pumps.

UNIT – I

BASIC CONCEPTS AND PROPERTIES Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

UNIT – II

FLUID KINEMATICS AND FLUID DYNAMICS Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net – fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter, Pitot tube - dimensional analysis - Buckingham's ? Theorem- applications - similarity laws and models.

UNIT – III

INCOMPRESSIBLE FLUID FLOW Viscous flow - Navier - Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy - weisback's equation - pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

UNIT – IV

HYDRAULIC TURBINES Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagram's - head and specific work - components of energy transfer - degree of reaction.

Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencies -performance curve for turbines.

UNIT – V

HYDRAULIC PUMPS Pumps: definition and classifications - Centrifugal pump: classifications, working



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principles, velocity triangles, specific speed, efficiency and performance curves - Reciprocating pump: classification, working principles, indicator diagram, work saved by air vessels and performance curves - cavitations in pumps - rotary pumps: working principles of gear and vane pumps

Text Book/References Books/ Websites

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 1983.
2. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi (7th edition), 1995.
3. Vasandani, V.P., "Hydraulic Machines - Theory and Design", Khanna Publishers, 1992.

4. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmi publications (P) Ltd., New Delhi, 1995.
5. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
6. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 1998.
7. Som, S.K., and Biswas, G., "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd edition, 2004.

Suggested List of Laboratory Practical (Expandable):

- 1 To determine the coefficient of impact for vanes.
- 2 To determine coefficient of discharge of an orifice meter.
- 3 To determine the coefficient of discharge of Notch (V and Rectangular types)
- 4 To determine the friction factor for the pipes.
- 5 To determine the coefficient of discharge of venturimeter.
- 6 To determine the coefficient of discharge, contraction & velocity of an orifice.
- 7 To verify the Bernoulli's Theorem.
- 8 To find critical Reynolds number for a pipe flow.
- 9 To determine the meta-centric height of a floating body.
- 10 To determine the minor losses due to sudden enlargement, sudden contraction and bends.
- 11 To show the velocity and pressure variation with radius in a forced vortex flow.



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Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credit
B.E. ME	ARTIFICIAL INTELLIGENCE & NEURAL NETWORK	ME- 5031	3L-1T-2P	4

Course Outcomes:

After studying this course, students will be able to

1. Learn about importance of AI techniques. Adoption of Artificial Intelligence (AI) technologies is widely expanding in our society.
2. Know the exact application of AI Techniques. Such applications use AI techniques to interpret information from a wide variety of sources and use it to enable intelligent, goal-directed behavior.
3. Understand the working of Modern AI based systems.
4. Know about sensors used in AI based systems.

Unit-1

Introduction to Artificial Intelligence Main components and characteristics of AI (Feature Engineering, ANN, Deep Learning), Applications of AI, Advantages and disadvantages of AI, Goals of AI, Comparison of Programming of a System with AI and without AI, Challenges in AI, Programming languages preferably used in AI, Techniques/Algorithms used in AI, AI Software platforms, Future of AI.

Unit-2

Various types of production systems and search techniques: Types of production systems, Characteristics of production systems, Study and comparison of breadth first search and depth first search. Techniques, other Search Techniques like hill Climbing, Best first Search. A* algorithm, AO* algorithms etc, and various types of control strategies.

Unit-3

Knowledge Representation and Probabilistic Reasoning: Problems in representing knowledge, knowledge representation using propositional and predicate logic, comparison of propositional and predicate logic, Resolution, refutation, deduction, theorem proving, inferencing, monotonic and nonmonotonic reasoning. Probabilistic reasoning, Bayes' theorem, semantic networks, scripts, schemas, frames, conceptual dependency, fuzzy logic, forward and backward reasoning.

Unit-4

Game playing techniques: Minimax procedure, alpha-beta cut-offs etc, planning, Study of the block world problem in robotics, Introduction to understanding and natural languages processing.

Unit-5

Introduction to Neural Network (NN): Introduction, benefits of neural network, models of Neural Network.

Learning Processes: Various techniques used in learning, introduction to Artificial neural networks, common sense, reasoning, Convolution Neural Network, Feedforward Neural Network, Recurrent Neural Network, Multilayer perceptron, Architecture / Three Layers in Artificial Neural Networks, Implementation of ANN, Applications of ANN in images, signals and language some example of expert systems.

Text Book/References Books/ Websites

1. LRich E and Knight K, "Artificial Intelligence", TMH, New Delhi.
2. Nelsson N.J., "Principles of Artificial Intelligence", Springer Verlag, Berlin,
3. *Stuart Russell , Artificial Intelligence: A Modern Approach , 3rd Edition), Peter Norvig, PHI, ISBN13: 978-0136042594, ISBN-10: 0136042597
4. B. Yegnanarayana , Artificial Neural Networks PHI
5. Schalkof, Artificial Neural Networks. Mc Graw HILL Education
6. S. Haykin: Neural Networks- A Comprehensive Foundation, PHI Learning,

EVALUATION: Evaluation will be continuous and integral part of the class as well as through external assessment



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B.E. ME	MECHATRONICS ENGINEERING	ME- 5041	3L-1T-2P	4

Course Outcomes: After studying this course, students will be able to

CO 1 Identification of key elements of mechatronics system and its representation in terms of block diagram,

CO 2 Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital

C03 Understand principles of sensors, its characteristics, interfacing with DAQ microcontroller

Interfacing of Sensors, Actuators using appropriate DAQ micro- controller

CO 4 Outline appropriate sensors and actuators for an engineering application.

CO 5 Classify various sensors, transducer and actuators according to the applications.

CO 6 Select a controller for a mechanical and mechatronics system.

Unit-1

INTRODUCTION: Introduction to mechatronics, Examples of mechatronics systems, definition of Mechatronics, Multi-disciplinary scenario, origins. Evaluation of Mechatronics, An over view of mechatronics, Design of mechatronics system. Measurements system and function of main elements of measurement systems. Need for mechatronics in industries. Objectives, advantages and disadvantages of mechatronics. Microprocessor based controllers. Principle of working of engine management system, automatic washing machine.

Unit-2

TRANSDUCERS AND SENSORS: Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors.

MICROPROCESSOR: Introduction, Microprocessor based digital control. Digital number system, binary and hexadecimal number system, Logic functions, Karnaugh Map, Data word representation basic Elements of control systems.

Unit-3

MICROPROCESSOR ARCHITECTURE: 8085A processor architecture Terminology-such as, CPU, memory and address, ALU, assembler, data, registers, Fetch cycle, write cycle, state, bus interrupts. Micro controllers - difference between microprocessor and micro controllers. Requirements for control and their implementation in micro controllers. Classification of micro controllers.

Unit-4

ELECTRICAL ACTUATORS: Actuator and actuator system. Classifications of actuator system with examples. Mechanical switches. Concept of bouncing Methods of Preventing bouncing of mechanical switches. Solenoids, Relays. Solid state switches - Diodes, Thyristors, Triacs, Transistors, Darlington pair.

Electrical actuator. Principle, construction and working of AC, DC motors, stepper motors, permanent motors, servomotors, Servo systems and control

HYDRAULIC ACTUATORS: Valves - Classifications, Pressure Control Valves - Pressure relief valves, Pressure regulating/reducing valves, Pressure sequence valve. Flow control valves - Principle, needle valve, globe valve. Direction control valve -sliding spool valve, solenoid operated.

Unit-5

SINGLE CONDITIONING: Concept, necessity, op-amps, protection, filtering, wheat stone bridge - Digital Signals - Multiplexer. Data acquisition - Introduction to signals, and systems Introduction to digital signal processing - Concepts and different methods.

Text Book/References Books/ Websites

1. Mechatronics - Principles, Concepts and applications - Nitaigour and Premchand, Mahilik - Tata McGraw Hill -2003
2. Mechatronics - W. Bolton, Longman, Pearson Education Asia -2nd Edition, 2001.
3. Introduction to mechatronics and measurement systems -David G. Alciatore & Michel BiHstand - Tata McGraw Hill -2000
4. Mechatronics - H.D. Ramachandra - Sudha Publication -2003
5. Mechatronics by HMT Ltd. - Tata McGrawHill -2000.
6. Mechatronics System design by Devadas Shetty and Richard A. Kark-Thomas Learning -1997.
7. Mechatronics an Introduction by Robert H Bishop - CRC
8. Mechatronics systems Fundamentals by Rolf Isermann – Springer
9. Mechatronics: An Integrated Approach by C.W.De Silva, Publisher: CRC;
10. Microprocessor and Architecture, Programming and Applications with 8085/8085A- R.S.Ganokar, *Wiley Eastern*