



MANIPAL UNIVERSITY JAIPUR

School of Automobile Mechanical and Mechatronics Engineering

Department of Automobile Engineering
Course Hand-out

Automotive pneumatics & hydraulic systems | AU 1409 | 4 Credits | 3 0 2 4

Session: Jan 19 – May 19 | Faculty: Rakesh Kumar | Class: II Year IV Semester

Course Outcomes: At the end of the course, students will be able to

- [1409.1]. Describe various types of fluid flow and its application in an automobile.
- [1409.2]. Compute flow rate through venturimeter, orifice meter and notches and interpret it to automobile.
- [1409.3]. Develop shear stress and velocity distribution through, circular pipe and between two fixed parallel plates.
- [1409.4]. Describe pumps, torque convertor and fluid coupling, their importance in Automobile.
- [1409.5]. Describe various pneumatic and hydraulic valve, and their functions
- [1409.6]. Design and develop Pneumatic circuits for automotive component to enhance the employability skills.

A. SYLLABUS

Fundamentals: Definition and properties of fluids, intensity of pressure, variation of pressure in a static fluid, Absolute, Gauge, Atmospheric and Vacuum pressure Manometers, **Fluid statics:** Hydro static forces and Centre of Pressure on vertical and inclined plane surfaces, hydrostatic applications in braking systems (master cylinders, wheel cylinders, force distribution in brake linings), clutch cylinder, hydrostatic drives used in automobile and earthmoving equipment, **Kinematics and Dynamics of fluid flow :** Types of fluid flow; laminar flow, turbulent flow applications in engine intake, exhaust systems and torque converters; Continuity equation, one dimensional Euler's equation of motion, Bernoulli's energy equation and their application in vehicle dynamics, **Fluid flow measurements:** Venturi meter, Orifice meter, Pitot tube and Notch, **Viscous Flow :** Reynolds Number, laminar flow through circular pipes & tubes, Hagen Poiseuille's equation, laminar flow between fixed parallel plates, applications in automotive lubrication systems **Flow Through Pipes & Tubes:** Minor and Major losses, Darcy and Chezy equation. **Fundamentals of Automotive Hydraulic Pneumatic Pumps:** gear pumps, rotary pumps, crescent pumps, fuel pumps, oil pumps and coolant pumps etc., (Constructional feature, working principle velocity triangle, governing mechanisms and simple problems), **Automotive Hydraulic & Pneumatic Devices:** torque convertors, fluid couplings, **Automotive Pneumatic Hydraulic valves:** Construction and working of various types of direction control, pressure control, flow control valves, servo valve, proportional valve, accumulator, **Hydraulic & Pneumatic circuits:** Regeneration, meter in, meter out, bleed off, sequencing, counter balancing, pressure reducing and typical application circuits.

Lab: Flow measuring devices: **Hydraulic actuators:** linear actuators- single acting & double acting cylinder, rotary actuator- Hydraulic motor, Stepper Motor, Hydraulic pumps: gear, vane and piston pump. **Hydraulic valves:** direction control, pressure control, and flow control valves, servo valve, and proportional valve. Hydraulic accumulator, Hydraulic trainer, Pneumatic trainer, hydraulic braking assembly, Anti-lock braking

B. Text Books:

- T1. V.L. Streeter and E. Beinzamin, *Fluid Mechanics*, Willy Int, New York. 1998.
- R1. K. L. Kumar, *Engineering Fluid Mechanics*, Eurasia Publishing House, New Delhi. 2000.
- R2. R. K. Bansal, *Fluid Mechanics and Hydraulic Machines*, Laxmi Publication. New Delhi, 2006.
- R3. D S Kumar, *Fluid Mechanics and Fluid Power Engineering*, Katson Publishing House. New Delhi, 2001.

