Oil Hydraulics and Pneumatics
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Introduction to Oil Hydraulics and Pneumatics
Lecture – 01
Part 1: Introduction, Learning Objectives, Course Content and References

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My name is Somashekhar course faculty for this course. Hello friends, very good morning to one and all, warm welcome to the course Oil Hydraulics and Pneumatics; to be conducted under National Programme on Technology Enhanced Learning known as NPTEL is a project of MHRD Government of India.

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We will begin with today's lecture 1 organization of presentation is as follows. Let us we will quickly see the preamble of the course Learning Objective Course outline list of References to be followed for the course.

Let us we will start with power transmission methods; merits of fluid power system demerits of the fluid power system, brief history of fluid power system and major divisions. Finally, I will concluding remarks on the today's lecture.

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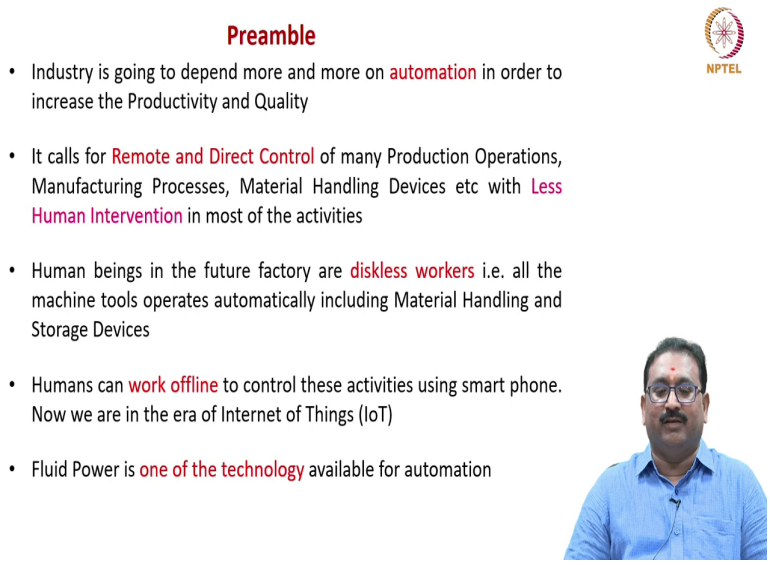

Let us we will see friends why we want to study this course, what is the need of this course in current scenario. As we know friends industry is going to depend more and more on automation, in order to increase the productivity and a quality.

It calls for remote and direct control of many production operations, manufacturing processes, material handling devices etcetera with a less human intervention in most of the activities.

Human beings in the future factory are deskless workers; that is all the machine tools operate automatically including material handling and storage devices. Humans can work offline to control these activities using Smartphone now we are in the era of Internet of Things IoT. Fluid power is one of the technology available for automation.

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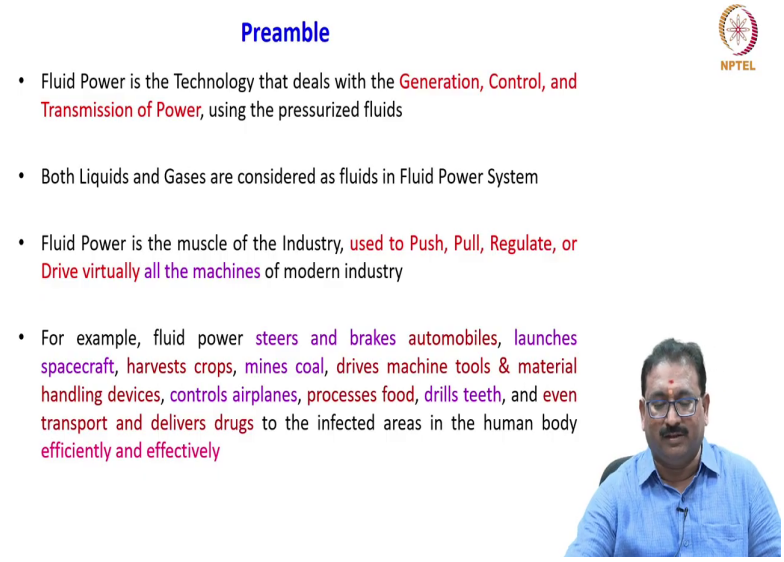

So, what is this fluid power? Fluid power is the technology that deals with the generation, control and transmission of power; using the pressurized fluids. Both liquids and gases are considered as a fluids in the fluid power system.

Fluid power is the muscle of the industry, used to push pull regulate and drive virtually all the machines of the modern industry. For example, fluid power steers and brakes automobiles, launches, spacecraft, harvest, crops, mines, coal, drives machine tools and material handling devices; control airplanes processes food, drills teeth and even transport and delivers a drugs to the infected areas in the human body efficiently and effectively.

Just you will see this the major areas covered are all automobiles, agricultural and medical industry also.

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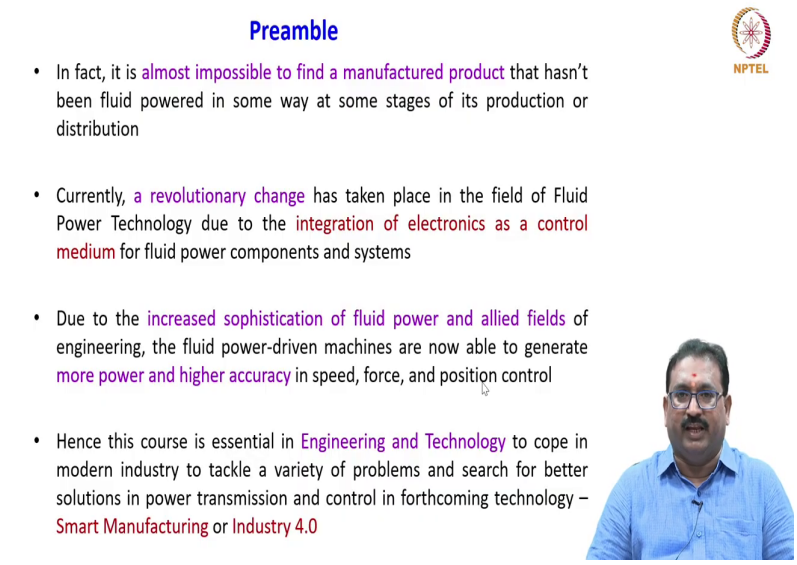

In fact, it is impossible to find a manufactured product that has not been fluid powered in some way at some stages of its production or distribution. Currently, a revolutionary change has taken place in the field of fluid power technology due to the integration of electronics as the control medium for fluid power components and a systems.

Also, nowadays artificial intelligence use also use to control the processes. Due to the increased sophistication of fluid power and allied fields of engineering, the fluid power driven machines are now able to generate much power and higher accuracy in speeds force and position control.

Hence this course is essential in engineering and technology to cope in modern industry, to tackle a variety of problems and search for better solutions in power transmission and control

in forthcoming technology what we can briefly call it as a smart manufacturing or industry 4.0.

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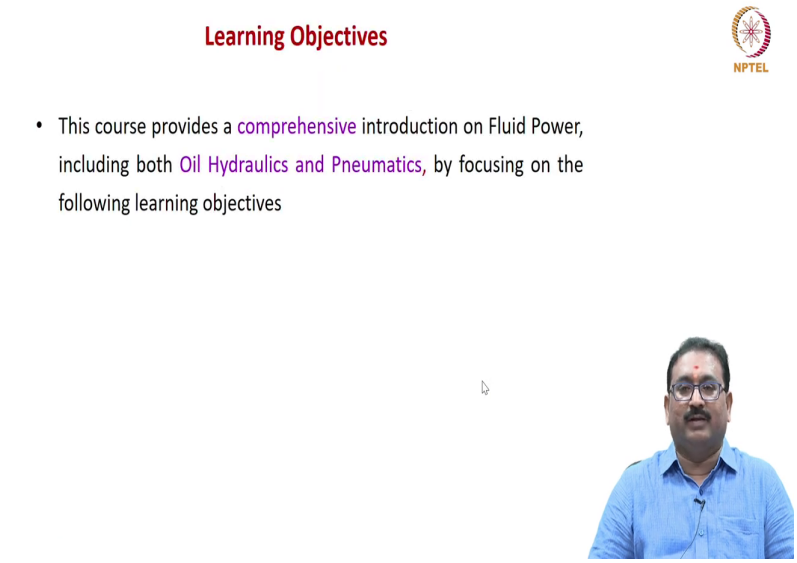

Based on this preamble, the learning objectives are formulated in such a way that; this course provides a comprehensive introduction on fluid power, including both oil hydraulics and a pneumatics, by focusing on the following learning objectives.

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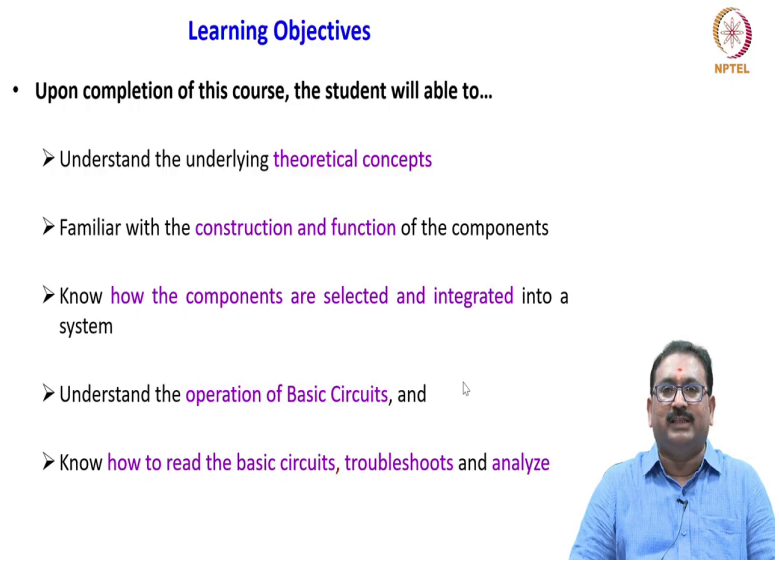

Upon completion of this course, the student will able to understand the underlying theoretical concepts. They will able to familiar with the construction and function of the components. Know how the components are selected and integrated into a system. Understand the operation of basic circuits and know how to read the basic circuits and troubleshoots and analyze the circuits.

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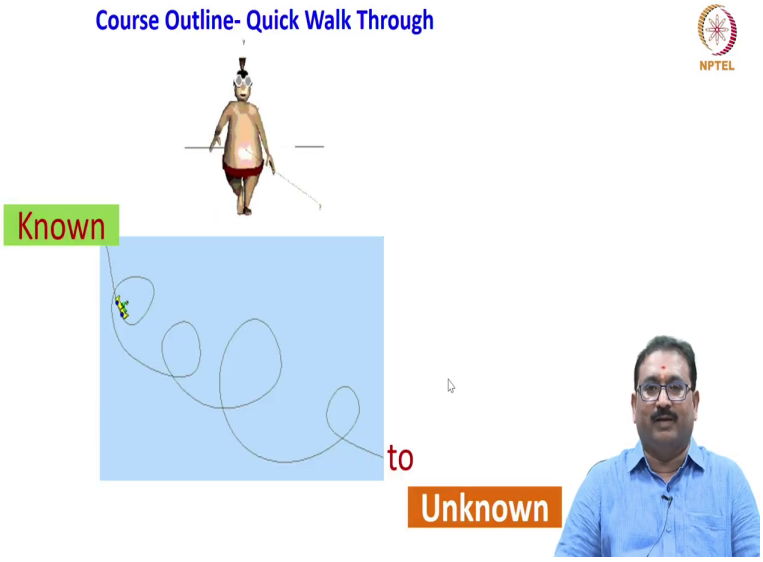

Based on the learning objective, the course outline is formulated as follows. Let us we will begin with known to unknown what we are studying in the fluid power system.

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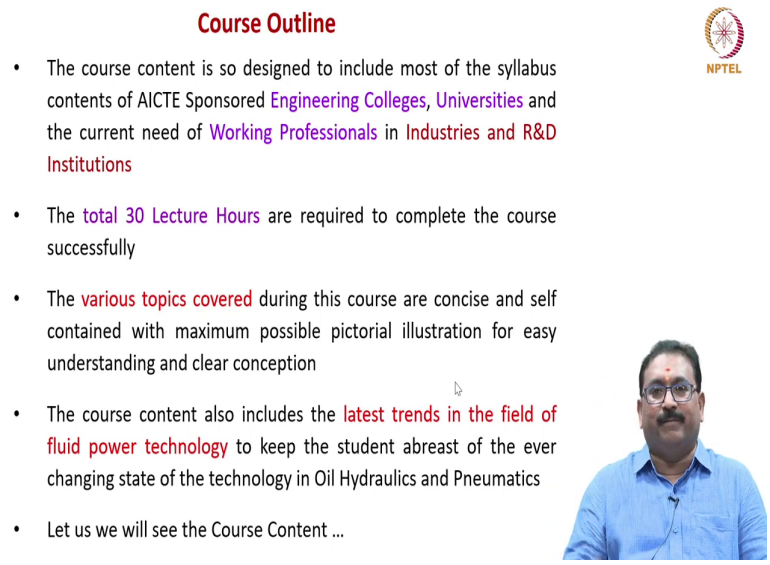

The course content is so designed to include most of the syllabus contents of the AICTE sponsored Engineering colleges; universities and the current need of working professionals in industries and R and D institutions. The total 30 lecture hours are required to complete the course successfully.

If some class are required more also, we are able to discuss in the 4 to 5 classes also extra if needed. The various topics covered during this course are concise and self contained with maximum possible pictorial illustration for easy understanding and clear conception. The course content also includes the latest trends in the field of fluid power technology to keep the student abreast of the ever changing state of the technology in oil hydraulics and pneumatics.

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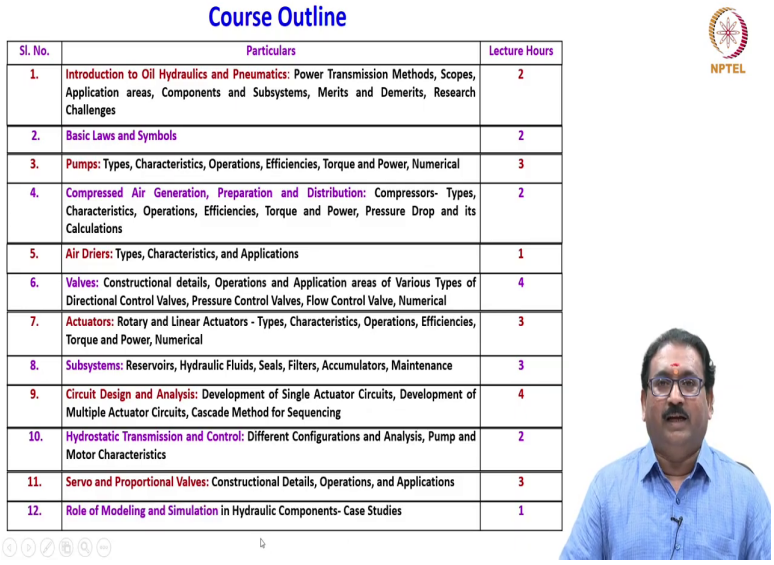

Let us we will see the course content now we will move on to the course outline. The entire course is covered in 30 lecture hours, in 12 weeks durations. Let us we will see now. Begin with introduction to oil hydraulics and pneumatics, here we will discuss mainly the power transmission methods, scopes, application areas, components and subsystems merits and demerits research challenges and status and development of the fluid power system.

Later we will move on to the basic laws and a symbols. Just we will quickly recap the basic laws Pascals law, Bernoulli's laws and various types of gas laws. And then we will move on to the symbols which are very essential to represent; all the fluid power components this is a prerequisite to represent the circuits either it may be the oil hydraulic circuit or a pneumatic circuits.

Later we will move on to the pumps. Here we are discussing the main types of hydrostatic pumps, generally the gear pump, vane pump and a piston pumps. For each we will discuss the characteristics operations efficiencies basically the volumetric efficiency mechanical efficiency and total efficiencies of the pump. Then torque and power and simple numerical's on the various types of pumps.

Next move on to the pneumatics here we will discuss compressed air generation preparation and distribution. Here we will discuss mainly the compressors which are the heart of the pneumatics.

Here we will discuss various types of compressors, characteristics, operations, efficiencies, torque and power and later we will move on to the pressure drop and its calculation which is a prerequisite in the pneumatics. Pressure drop is as low as possible from the generating to the distribution areas.

Later we will move on to the air dryers; as we know in pneumatics we required clean and dry air to get clean and dry air we are using the air driers. Here we will discuss the various types characteristics and applications; later we will move on to the valves friends. Here we will discuss the constructional details operations application areas and various types of direction control valves, pressure control valves and flow control valves.

Later we will move on to the actuators, which are the working elements in the fluid power systems. Here we will discuss rotary actuators and a linear actuators based on the motion required. Here we will discuss various types, characteristics, operations and efficiencies like a volumetric efficiency, mechanical efficiency and a overall efficiencies; also we will see the torque and power and simple numerical's on the rotary as well as linear actuators.

Later we will move on to the subsystems or auxiliary components. Here we will discuss the reservoirs hydraulic fluids and its properties and desirable properties. Here we will discuss the seals filters accumulators and also we will see the some of the tips in the maintenance of fluid power components.

Later we will move on to the circuit design and analysis, which is the heart of the course. Here we will discuss the development of single actuator circuits, development of the multiple actuators actuator circuits cascading method for sequencing the various cylinders. Next we will move on to the hydrostatic transmission and control; here we will discuss different configurations and analysis pump and motor characteristics and many more.

Next we will move on to the advanced fluid power system components; like a servo valves and a proportional valves these are known as the closed loop systems. Here we will discuss constructional details operations and applications of various types of servo and proportional valves. Later we will move on to the role of modeling and simulations in hydraulic components.

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We will discuss some of the case studies after knowing the course content every student has to refer various types of books, journals and much more materials. Just I will give you some of the list of references which are essential for this course.

The Anthony Esposito Fluid Power with Applications. And Industrial Hydraulics by John J. Pippinger and Tyler Gregory Hicks. Pease and Pippenger basic hydraulics Prentice Hall publications.

Then Fluid Power Circuits and Controls; Fundamentals and Applications John S. Cundiff. Manring and Fales Hydraulic Control Systems, John Wiley and Sons Herbert E. Merritt Hydraulic Control System in which detailed analysis of the electro hydraulic servo valve paper nozzle servo valves are discussed in this book in detail.

Allen C Morse Electrohydraulic Servomechanisms Mcgraw Hill publication. John Watton Fluid Power Systems. Prentice Hall International Limited. Edward W Reed Fluid Power with Microprocessor Control an introduction Prentice Hall publication.

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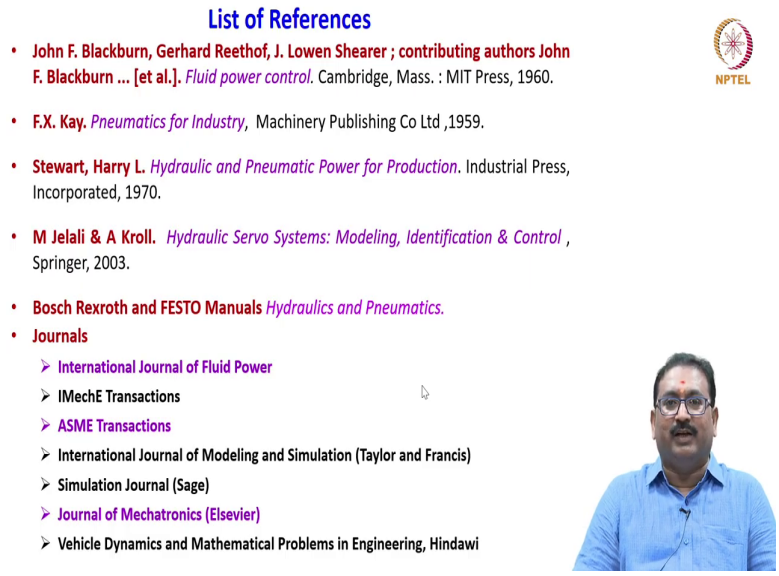

Also we will refer John F. Blackburn et al in which you will see the detailed analysis of the valves spool valves flow forces and many thing in a fluid power control; it is edited by the Blackburn with many authors.

Pneumatics for industry by F. X. Kay. Stewart, Harry L. Hydraulic and Pneumatic Power for Production. Jelali and Kroll Hydraulic Servo Systems modeling identification and control Springer publication it is. Then very important friends is Bosch Rexroth and FESTO Manuals; which are easily available in the most of the libraries they will discuss there are many types of valves pumps actuators and circuits also.

Last, but not the least please try to read the journals on fluid power technology what you will call International Journal of Fluid Power IMechE Transactions, ASME Transactions, International Journal of Modeling and Simulations, Simulation Journal, Journal of

mechatronics vehicle dynamics and mathematical problems in engineering. There are plenty of journals are there, which will take you to the what is going on fluid power system around the world.