Ref No:

Sri krishna Institute of Technology, Bangalore

COURSE PLAN

Academic Year 2019-20

Program:	B E – Mechanical Engineering
Semester :	7
Course Code:	15ME72
Course Title:	Fluid Power Systems
Credit / L-T-P:	4 / 4-0-0
Total Contact Hours:	50
Course Plan Author:	Mr.PRAMOD S N / Mr.SHANKAREGOWDA K C

Academic Evaluation and Monitoring Cell

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Note : Remove “Table of Content” before including in CP Book
Each Course Plan shall be printed and made into a book with cover page
Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	ME
Semester:	7	Academic Year:	2019-20
Course Title:	Fluid power system	Course Code:	15ME72
Credit / L-T-P:	4 / 4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50 Hours	SEE Marks:	80 Marks
CIA Marks:	20 Marks	Assignment	1 / Module
Course Plan Author:	Pramod S N	Sign ..	Dt:
Checked By:	Shankaregowda K C	Sign ..	Dt:
CO Targets	CIA Target : ……. %	SEE Target:	……. %

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Content	Teaching Hours	Identified Module Concepts	Blooms Learning Levels
1	Introduction to fluid power systems,components, advantages and applications. Transmission of power at static and Dynamic states. Pascal's law and its applications. Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and Pressure on hydraulic fluid. Seals, sealing materials, Compatibility of seal with fluids. Pressure drop in hoses/pipes. Heat exchangers. Control heat exchangers. Types of pipes, Hoses and quick acting couplings. Fluid conditioning through filters, Strainers; sources of contamination and contamination	10	Fluid Power	L2
2	Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps Fixed,Pump performance characteristics, pump selection factors procedure Problems on pumps. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor. Cost estimation of mechanical process, idling time. Actuators:Classification cylinder and hydraulic motors, Hydraulic cylinders, single acting cylinder Mounting arrangements, cushioning, special types of cylinders, problems on cylinders. Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flow rate, andhydraulic motor performance; numerical problems. Symbolic representation of hydraulic actuators (cylinders and motors).	10	Working principles	L2
3	Components and hydraulic circuit design Components:Classification of control valves, Directional Control Valves-symbolic representation, Constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valves Pressure control valves - types, direct operated types and pilot operated types. Flow Control Valves -compensated and non- compensate d FCV, Needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, Design: Control of single andDouble -acting hydraulic cylinder,	10	Circuits	L2

	regenerative circuit, pump unloading circuit, Double pump hydraulic system, counter balance valve application, Hydraulic cylinder sequencing circuits, cylinder synchronizing circuit Hydraulic circuit for force multiplication Speed control of hydraulic cylinder- metering in, metering out Bleed off circuits. Pilot pressure operated circuits Hydraulic Circuit examples with accumulator.			
4	Introduction to Pneumatic systems:Pneumatic power system, Advantages, limitations, applications, Choice of working medium. Characteristics of compressed air and air compressors. Structure of pneumatic control System Fluid conditioners-dryers and FRL unit. Pneumatic Actuators: Linear cylinder – types of cylinders, working End position cushioning, seals, mounting arrangements, and applications. Pneumatic Actuators: Linear cylinder – types of cylinders, working End position cushioning, seals, mounting arrangements, and applications. Rotary cylinders- types, construction and application, Symbols. Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, Pneumatic Control Valves: DCV such as poppet, spool, suspended se control valves, types and construction Use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure.	10	Pneumatic System	L2
5	Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust Signal Processing Elements: Multi- Cylinder Application: Coordinated and sequential motion control, Control: Principles - signal input and output, pilot assisted solenoid control of directional control Signal elimination methods, Cascading method principle, Practical application Air throttling. Valves, use of relay and contactors. Control circuitry for simple signalcylinder applicationUse of Logic gates - OR and AND gates in pneumatic Applications. Motion and control Diagrams. Electro- Pneumatic Practical examples involving the use of logic gates. Multi- Cylinder Application: Coordinated and sequential motion control, motion and control diagrams. Signal elimination methods, Cascading method- principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves). Electro- Pneumatic Control: Principles - signal input and output, pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple signal cylinder application.	10	Logic control	L2
-	**Total**	**50**	-	-

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).
1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2, 3, 4, 5	1.Anthony Esposito, “Fluid Power with applications”, Pearson edition,2000 . 2. Majumdar S.R., “Oil Hydraulics”,TalaMcGRawHllL, 2002 .	1,2,3,4,56	Available

	3. Majumdar S.R., "Pneumatic systems - Principles and Maintenance",Tata McGraw-Hill, New Delhi, 2005	,7,8,9,10,	
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	-	-
1, 2	John Pippenger, Tyler Hicks, "Industrial Hydraulics", McGraw Hill International Edition, 1980.	?	In Lib
1, 2	Andrew Par, Hydraulics and pneumatics, Jaico Publishing House, 2005.	?	Not Available
3, 4, 5	FESTO, Fundamentals of Pneumatics, Vol I,IIandIII.	?	Not Available
	Herbert E. Merritt, "Hydraulic Control Systems", John Wiley and Sons, In		Not Available
C	**Concept Videos or Simulation for Understanding**	-	-
C1			
C2			
C3			
D	**Software Tools for Design**	-	-
E	**Recent Developments for Research**	-	-
F	**Others (Web, Video, Simulation, Notes etc.)**	-	-
1			
?			

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1,2,3,	15ME44	Fluid Mechanics	Module 1,2 &3	4	-	L2

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1	Fluid power	Higher Study		Understand L2

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level

1	15ME72.1	Understand and analyze fluid power and modes	5	Fluid power	Chalk and Board	Assignment,Unit test and CIA	L2 Understand
1	15ME72.2	Select components as per circuitry requirement	5	Components	Chalk and Board	Assignment,Unit test and CIA	L2 Understand
2	15ME72.3	Visualize the construction and working of pumps	6	Mechanism	Chalk and Board	Assignment,Unit test and CIA	L2 Understand
2	15ME72.4	Apply control components as per design	4	Features	Chalk and Board	Assignment,Unit test and CIA	L2 Understand
3	15ME72.5	Components distribution	6	Components	Chalk and Board	Assignment,Unit test and CIA	L2 Understand
3	15ME72.6	Design of circuit	4	Circuits	Chalk and Board	Assignment,Unit test and CIA	L2 Understand
4	15ME72.7	Understand pneumatic structure	5	Pneumatic systems	Chalk and Board	Assignment,Unit test and CIA	L2 Understand
4	15ME72.8	Interpreting circuit	5	Circuit	Chalk and Board	Assignment,Unit test and CIA	L2 Understand
5	15ME72.9	Logic control	5	Actuation	Chalk and Board	Assignment,Unit test and CIA	L2 Understand
5	15ME72.10	Integration b/w systems	5	Integration	Chalk and Board	Assignment,Unit test and CIA	L2 Understand
-	-	**Total**	**62**	-	-	-	**L2-L4**

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Petroleum Industry	CO1	L2
	Oil distribution pipelines	CO2	L2
2	Computational fluid dynamics	CO3	L2
	Programmable controllers	CO4	L2
3	Centralized distribution cell in chemical industries	CO5	L2

	Grid companies	CO6	L2
4	Small and medium automation	CO7	L2
	Academic demonstration	CO8	L2
5	Actuation	CO9	L2
	Design department	CO10	L2

3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.
To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Modules	Mapping		Mapping Level	Justification for each CO-PO pair	Level
-	**CO**	**PO**	-	**'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'**	-
	CO1	PO1	L2	Apply the knowledge of fluid power	L2
	CO1	PO2	L2	Since it is basic science -No mapping	L2
	CO1	PO3	L2	Atudents will not be Designing/developing of solution-No mapping	L2
	CO1	PO4	L2	Since no conduction on investigations of complex Problems-No mapping	L2
	CO1	PO5	L2	No Modern tools are used -No mapping	L2
	CO1	PO6	L2	No inpact on engineers and society-No mapping	L2
	CO1	PO7	L2	Will not be affected on environment and sustainability-No mapping	L2
	CO1	PO8	L2	Since the study is limited to basics -No mapping	L2
	CO1	PO9	L2	Will not be working either Individual nor team work-No mapping	L2
	CO1	PO10	L2	NO instruction will be given -No mapping	L2
	CO1	PO11	L2	No application of management and finance principles involved -No mapping	L2
	CO1	PO12	L2	Due to change in technology-No mapping	L2
	CO2	PO1	L3	No application of Engineering knowledge-No mapping	L2
	CO2	PO2	L2	No problem analysis as it is basic science-No mapping	L2
	CO2	PO3	L2	Design and development of solution	L2
	CO2	PO4	L2	Their is no investigations of complex Problems-No mapping	L2
	CO2	PO5	L2	No creation of sketches -No mapping	L2
	CO2	PO6	L2	The engineer and society issues -No mapping	L2
	CO2	PO7	L2	No impact on environment and sustainability-No mapping	L2
	CO2	PO8	L2	Normal Engg norms and practice -No mapping	L2
	CO2	PO9	L2	Their is no projects to be done -No mapping	L2
	CO2	PO10	L2	No usage of documents -No mapping	L2
	CO2	PO11	L2	No usage Project management and finance principals -No mapping	L2
	CO2	PO12	L2	Technology dependent -No mapping	L2
	CO3	PO1	L2	Since there is no Engineering basics -No mapping	L2
	CO3	PO2	L2	No identification of problems -No mapping	L2
	CO3	PO3	L2	Design and development of solution	L2
	CO3	PO4	L2	Will not conduct investigations of complex Problems-No mapping	L2
	CO3	PO5	L2	No creation ans simulation-No mapping	L2
	CO3	PO6	L2	No obligation on societal and health issues-No mapping	L2
	CO3	PO7	L2	No impact on environment and sustainability-No mapping	L2
	CO3	PO8	L2	Normal engg. practise-No mapping	L2
	CO3	PO9	L2	No projects and internships -No mapping	L2
	CO3	PO10	L2	No documents -No mapping	L2
	CO3	PO11	L2	No Project management and finance principals -No mapping	L2
	CO3	PO12	L2	Technology dependent No mapping	L2
	CO4	PO1	L2	Since there is no basic engg.science-No mapping	L2
	CO4	PO2	L2	No research activity-No mapping	L2
	CO4	PO3	L2	No process of design and development of solution-No mapping	L2
	CO4	PO4	L2	No investigations of complex Problems-No mapping	L2
	CO4	PO5	L2	Application of modern tool	L2
	CO4	PO6	L2	No engineer and society issues -No mapping	L2

	CO4	PO7	L2	No impact on environment and sustainability-No mapping	L2
	CO4	PO8	L2	Normal engg. Practice -No mapping	L2
	CO4	PO9	L2	No project work -No mapping	L2
	CO4	PO10	L2	No instruction-No mapping	L2
	CO4	PO11	L2	No project management and finance principles-No mapping	L2
	CO4	PO12	L2	Technical dependency-No mapping	L2
	CO5	PO1	L2	Engineering knowledge-No mapping	L2
	CO5	PO2	L2	No problem analysis-No mapping	L2
	CO5	PO3	L2	Design and development of solution for complex problems	L2
	CO5	PO4	L2	No research based knowledge -No mapping	L2
	CO5	PO5	L2	No creation of design and process-No mapping	L2
	CO5	PO6	L2	No legal issues-No mapping	L2
	CO5	PO7	L2	No impact on environment and sustainability-No mapping	L2
	CO5	PO8	L2	No application of engg. Practice -No mapping	L2
	CO5	PO9	L2	No Project work-No mapping	L2
	CO5	PO10	L2	No instruction-No mapping	L2
	CO5	PO11	L2	No Project management and finance principles -No mapping	L2
	CO5	PO12	L2	Technology dependence -No mapping	L2
	CO6	PO1	L2	No basic science -No mapping	L2
	CO6	PO2	L2	No identification of problem and analysis-No mapping	L2
	CO6	PO3	L2	No design process-No mapping	L2
	CO6	PO4	L2	No investigations of complex Problems-No mapping	L2
	CO6	PO5	L2	No modern tool content -No mapping	L2
	CO6	PO6	L2	No societal issues -No mapping	L2
	CO6	PO7	L2	No impact on environment and sustainability-No mapping	L2
	CO6	PO8	L2	Normal engg. Practice -No mapping	L2
	CO6	PO9	L2	To function effectively	L2
	CO6	PO10	L2	No documentation-No mapping	L2
	CO6	PO11	L2	No project management and finance principles -No mapping	L2
	CO6	PO12	L2	Technological dependency-No mapping	L2
	CO7	PO1	L2	Engineering knowledge-No mapping	L2
	CO7	PO2	L2	No problem analysis-No mapping	L2
	CO7	PO3	L2	Design and development of solution-No mapping	L2
	CO7	PO4	L2	Conduct investigations of complex Problems-No mapping	L2
	CO7	PO5	L2	Application of modern tool	L2
	CO7	PO6	L2	The engineer and society-No mapping	L2
	CO7	PO7	L2	Environment and sustainability-No mapping	L2
	CO7	PO8	L2	Ethics-No mapping	L2
	CO7	PO9	L2	Individual and team work-No mapping	L2
	CO7	PO10	L2	Communication-No mapping	L2
	CO7	PO11	L2	Project management and finance-No mapping	L2
	CO7	PO12	L2	Life-long learning-No mapping	L2
	CO8	PO1	L2	Basic engg. knowledge-No mapping	L2
	CO8	PO2	L2	No research -No mapping	L2
	CO8	PO3	L2	No Design/development of solution-No mapping	L2
	CO8	PO4	L2	No investigations of complex Problems-No mapping	L2
	CO8	PO5	L2	No tool usage-No mapping	L2
	CO8	PO6	L2	No societial issues-No mapping	L2
	CO8	PO7	L2	No impact on environment and sustainability-No mapping	L2
	CO8	PO8	L2	Normal engg practice -No mapping	L2
	CO8	PO9	L2	No projects-No mapping	L2
	CO8	PO10	L2	Effective communication	L2
	CO8	PO11	L2	No project management and finance principles -No mapping	L2
	CO8	PO12	L2	Technological dependencyNo mapping	L2

	CO9	PO1	L2	Requirnment of Basic science-No mapping	L2
	CO9	PO2	L2	No research-No mapping	L2
	CO9	PO3	L2	Design and development of solution-No mapping	L2
	CO9	PO4	L2	No investigations of complex Problems-No mapping	L2
	CO9	PO5	L2	Application of modern tool	L2
	CO9	PO6	L2	No societial issues-No mapping	L2
	CO9	PO7	L2	No impact on environment and sustainability-No mapping	L2
	CO9	PO8	L2	Normal Engg. Practice -No mapping	L2
	CO9	PO9	L2	No projects-No mapping	L2
	CO9	PO10	L2	No documentation-No mapping	L2
	CO9	PO11	L2	No project management and finance principles-No mapping	L2
	CO9	PO12	L2	Technological dependency -No mapping	L2
	CO10	PO1	L2	Basic knowledge-No mapping	L2
	CO10	PO2	L2	No problem analysis-No mapping	L2
	CO10	PO3	L2	No Design and development of solution-No mapping	L2
	CO10	PO4	L2	No investigations of complex Problems-No mapping	L2
	CO10	PO5	L2	Application of modern tool	L2
	CO10	PO6	L2	No engineer and societal issue-No mapping	L2
	CO10	PO7	L2	No impact on environment and sustainability-No mapping	L2
	CO10	PO8	L2	Normal engg. practice-No mapping	L2
	CO10	PO9	L2	No project work-No mapping	L2
	CO10	PO10	L2	No documentation-No mapping	L2
	CO10	PO11	L2	No project management and finance principles-No mapping	L2
	CO10	PO12	L2	Technological dependency No mapping	L2

4. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes														-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1	15ME72.1	Understand and analyze fluid power and modes	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
2	15ME72.2	Select components as per circuitry requirement	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	L2
3	15ME72.3	Visualize the construction and working of pumps	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	L2
4	15ME72.4	Apply control components as per design	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	L2
5	15ME72.5	Components distribution	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	L2
6	15ME72.6	Design of circuit	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	L2
7	15ME72.7	Understand pneumatic structure	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
8	15ME72.8	Interpreting circuit	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
9	15ME72.9	Logic control	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
10	15ME72.10	Integration b/w systems	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
-	**CS501PC**	**Average attainment (1, 2, or 3)**																-
-	*PO, PSO*																	

5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					

6. Content Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Modules	Gap Topic	Area	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1						

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Introduction to fluid power systems	10	2	-	-	1	-	2	CO1, CO2	L2
2	Pumps and actuators	10	2	-	-	1	-	2	CO3, CO4	L2
3	Components and circuit design	10	-	2	-	1	-	2	CO5, CO6	L2
4	pneumatic control systems	10	-	2	-	1	-	2	CO7, C08	L2
5	Pneumatic control systems	10	-	-	4	1	-	2	C09,C10	L2
-	**Total**	**50**	**4**	**4**	**4**	**5**	**-**	**10**	-	-

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	15	CO1, CO2, CO3, CO4	L2,L3
3, 4	CIA Exam – 2	15	CO5, CO6, CO7, C08	L2,L2
5	CIA Exam – 3	15	CO9, CO10	L2
1, 2	Assignment - 1	05	CO1, CO2, CO3, CO4	L2,L2
3, 4	Assignment - 2	05	CO5, CO6, CO7, CO8	L2,L2
5	Assignment - 3	05	CO9, CO10	L2
1, 2	Seminar - 1		-	-
3, 4	Seminar - 2		-	-
5	Seminar - 3		-	-
1, 2	Quiz - 1		-	-
3, 4	Quiz - 2		-	-
5	Quiz - 3		-	-
1 - 5	Other Activities – Mini Project	-	CO9, CO10	L2,L2
	Final CIA Marks	**20**	-	-

D1. TEACHING PLAN - 1

Module - 1

Title:	Introduction to fluid power	Appr Time:	16 Hrs
a	***Course Outcomes***		**Blooms level**
	The student should be able to understand :		
1	Understand and analyze fluid power and modes	5	L2
2	Select components as per circuitry requirement	5	L2
b	***Course Schedule***	-	-

Class No	Module Content Covered	CO	Level
1	Introduction to fluid power systems,	C01	L2
2	components, advantages and applications. Transmission of power at static and Dynamic states. Problems	C01	L2
3	Pascal's law and its applications. Fluids for hydraulic system:	C01	L2
4	Types, properties, and selection.	C01	L2
5	Additives, effect of temperature and Pressure on hydraulic fluid.Seals,	C01	L2
6	Sealing materials,Compatibility of seal with fluids.	C02	L2
7	Pressure drop in hoses/pipes. Heat exchangers.	C02	L2
8	Control heat exchangers.Types of pipes,	C02	L2
9	Hoses and quick acting couplings. Fluid conditioning through filters,	C02	L2
10	Strainers; sources of contamination and contamination	C02	L2
c	**Application Areas**	**CO**	**Level**
1	Petroleum Industry	CO1	L2
2	Oil distribution pipelines	CO2	L2
			L2
d	**Review Questions**	-	L2
1	State Pascal's law. Explain with neat sketch the basic hydraulic system with respect to forces and pressure in an enclosed tank	CO1	L2
2	With a neat sketch, Explain the working of a pressure compensated variable displacement hydraulic vane pump	CO1	L2
3	Write short notes on: i) Reservoir system ii) Filters	CO1	L2
4	What are the different problems arises in the hydraulic system and also mention the remedies	CO1	L2
5	List six desirable properties of hydraulic fluid and explain any three properties	CO1	L2
6	Discuss the problems caused by the gases in hydraulic fluids	CO2	L2
7	With a neat sketch explain pressure switch	CO2	L2
8	State and explain widely used types of seals in hydraulic systems	CO2	L2
9	A vane pump has a volumetric displacement of 90 $cm^{3.}$ It has rotor dia of 5 cm and cam ring dia of 7.5 cm and a vane width of 5 cms. What must be the eccentricity	CO2	L3
10	Give the classification of pumps	CO2	L2
e	**Experiences**	-	-
1			
2			

Module 2 – Pumps and actuators

		Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to understand :	-	**Level**
1	Computational fluid dynamics	5	L2
2	Programmable controllers	5	L2
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps,	CO3	L2
2	Piston pumpsFixed,Pump performance characteristics, pump selection factors procedure	CO3	L2
3	Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor,Cost estimation of mechanical process,	CO3	L2

	idling time.		
4	Actuators:Classification cylinder and hydraulic motors, Hydraulic cylinders, single `acting cylinder,	CO3	L2
5	Mounting arrangements, cushioning,special types of cylinders, problems on cylinders.	CO3	L2
6	Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor.	CO3	L2
7	Theoretical torque, power, flow rate, and hydraulic motor performance; numerical problems.	CO4	L2
8	Problems	CO4	L2
9	Symbolic representation of hydraulic actuators (cylinders and motors). Classification of pumps, Pumping theory of positive displacement pumps	CO4	L2
10	Construction and working of Gear pumps, Vane pumps, Piston pumps, Fixed Pump performance characteristics, pump selection factors procedure	CO4	L3
c	**Application Areas**	**CO**	**Level**
	The student should be able to:		
1	Computational fluid dynamics	CO3	L2
2	Programmable controllers	CO4	L2
d	**Review Questions**	-	-
1	Explain the mechanism of hydraulic loading	CO1	L2
2	A hydraulic motor has a displacement of 130cm^3 operates with a pressure of 105 bars & at a speed of 2000rpm.if actual flow rate is 0.005m^3/s and actual torque delivered by motor is 200n-m find Volumetric efficiency, Mechanical efficiency and overall efficiency	CO1	L2
3	Describe “END CUSHIONING” with a a neat sketch	CO1	L2
4	A hydraulic motor has volumetric efficiency of 90%and operates at 1750 rpm and pressure of 6.9 Mpa if the actual flow of the motor is 285 lpm and actual torque of the motor is 147Nm.find the overall efficiency	CO2	L2
5	State the advantages of an pneumatic system?	CO3	L2
6	Explain with a neat sketch, working of balanced vane motor	CO3	L2
7	Sketch and explain simple pneumatic system. also write a short note on cylinder mounting arrangement and it’s types	CO4	L2
8	Sketch and explain Rod less type of air cylinder?	CO4	L2
e	**Experiences**	-	-
1			

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	17ME72	Sem:	VII	Marks:	15	Time:	75 minutes
Course:	Fluid power systems						

-	-	**Note: Answer any 2 questions, each carry equal marks.**	**Marks**	**CO**	**Level**

1	a	State Pascal's law. Explain with neat sketch the basic hydraulic system with respect to forces and pressure in an enclosed tank?	5	CO1	L2
	b	With a neat sketch, Explain the working of a pressure compensated variable displacement hydraulic vane pump?	5	CO1	L2
	c	A vane pump has a volumetric displacement of 90 $cm^{3.}$ It has rotor dia of 5 cm and cam ring dia of 7.5 cm and a vane width of 5 cms. What must be the eccentricity?	5	CO2	L3
		OR			
2	a	List six basic components required in a hydraulic power system and state the essential functions of each?	5	CO2	L2
	b	With neat sketch, Explain Vane pump and obtain an expression for the volumetric displacement of the pump?	5	CO2	L2
	c	What are the important considerations when selecting a pump for a particular application?	5	CO2	L2
3	a	Explain the mechanism of hydraulic loading	5	CO2	L2
	b	With a neat sketch explain static and dynamic state of fluid		CO2	L2
	c	A hydraulic motor has a displacement of 130cm^3 operates with a pressure of 105 bars & at a speed of 2000rpm.if actual flow rate is 0.005m^3/s and actual torque delivered by motor is 200n-m find Volumetric efficiency, Mechanical efficiency and overall efficiency	5	CO2	L3
4	a	Explain with a neat sketch, working of Double acting pneumatic cylinder	5	CO2	L2
	b	Sketch and explain Rod less type of air cylinder?	5	CO2	L2
	c	Write a note on characteristics if compressed air? Sketch and explain turbine type air motor	5	CO2	L2

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	15ME72	Sem:	VII	Marks:	5	Time:	180 minutes
Course:	Fluid power systems						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1		State pascals law and explain with a neat sketch	5	CO1	L2
2		A hydraulic motor has a displacement of 130cm^3 operates with a pressure of 105 bars & at a speed of 2000rpm.if actual flow rate is 0.005m^3/s and actual torque delivered by motor is 200n-m find Volumetric efficiency, Mechanical efficiency and overall efficiency	5	CO2	L3
3		Describe "END CUSHINING" with a a neat sketch		CO2	L2
4		A hydraulic motor has volumetric efficiency of 90%and operates at 1750 rpm and pressure of 6.9 Mpa if the actual flow of the motor is 285 lpm and actual torque of the motor is 147Nm.find the overall efficiency	5	CO1	L2

5		State the advantages of an pneumatic system	5	CO1	L2
6		Explain with a neat sketch, working of balanced vane motor	5	CO1	L2
7		Sketch and explain simple pneumatic system.also write a short note on cylinder mounting arrangement and it's types	5	CO2	L2
8		Sketch and explain Rod less type of air cylinder	5	CO2	L2
9		Explain the mechanism of hydraulic loading	5	CO2	L2
10		Explain with a neat sketch, working of Double acting pneumatic cylinder	5	CO2	L2
11		Sketch and explain Rod less type of air cylinder	5	CO2	L2
12		Write a note on characteristics if compressed air? Sketch and explain turbine type air motor	5	CO2	L2
13		State Pascal's law. Explain with neat sketch the basic hydraulic system with respect to forces and pressure in an enclosed tank	5	CO1	L2
14		Explain the concept of fluid transmission in static state	5	CO1	L2
15		A vane pump has a volumetric displacement of 90 $cm^{3.}$ It has rotor dia of 5 cm and cam ring dia of 7.5 cm and a vane width of 5 cms. What must be the eccentricity?	5	CO1	L2
16		Write a note on heat exchangers	5	CO1	L2
17		What are the measures for control of contamination	5	CO1	L2
18		What do you mean by strainers.?	5	CO1	L2
19		Explain fluid conditioning through filters	5	CO1	L2
20		Explain pressure drop in hoses and pipes	5	CO1	L2
21		Give the classification of pipes and hoses	5	CO1	L2
22		What is the effect of temperature on hydraulics fluids ?	5	CO1	L2
23		What is the effect of pressure on hydraulics fluids ?	5	CO1	L2
24		What are the different additives for hydraulics fluids ?	5	CO1	L2
25		With a neat sketch, Explain the working of a pressure compensated variable displacement hydraulic vane pump	5	CO1	L2
26		Give the classification of pumps	5	CO2	L2
27		What do you mean by positive displacement pump?	5	CO2	L2
28		With a neat sketch explain working of Gear pump	5	CO2	L2
29		With a neat sketch explain working of vane pump	5	CO2	L2
30		With a neat sketch explain working of piston pump	5	CO2	L2
31		With a neat sketch explain working of fixed displacement pump	5	CO2	L2
32		With a neat sketch explain working of Gear pump variable displacement pump	5	CO2	L2
33		What are the factors needed for pump selection?	5	CO2	L2
34		With a neat sketch explain working of Gear motor	5	CO2	L2
35		With a neat sketch explain working of vane motor	5	CO2	L2
36		With a neat sketch explain working of piston motor	5	CO2	L2
37		Give any 2 expressions for motor performance	5	CO2	L2

D2. TEACHING PLAN - 2

Module – 3

Title:	Components and circuit design	Appr Time:	16 Hrs
a	***Course Outcomes***	**-**	**Blooms**
-	The student should be able to:	-	**Level**

1	Analyses the working of components	5	L2
2	Build the circuit for certain applications	5	L2
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Components and hydraulic circuit design Components:Classification of control valves, Directional Control Valves-symbolic representation,	CO5	L2
2	Constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valvesPressure control valves - types, direct operated types and pilot operated types. Flow Control Valves -compensated and non-compensated FCV,	CO5	L2
3	Needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV,	CO5	L2
4	Design:Control of single and Double -acting hydraulic cylinder, regenerative circuit, pump unloading circuit,	CO5	L2
5	Double pump hydraulic system, counter balance valve application,	CO5	L2
6	Hydraulic cylinder sequencing circuits, cylinder synchronizing circuit	CO5	L2
7	Hydraulic circuit for force multiplication	CO5	L2
8	Speed control of hydraulic cylinder- metering in, metering out	CO6	L2
9	Bleed off circuits. Pilot pressure operated circuits	CO6	L2
10	Hydraulic Circuit examples with accumulator.	CO6	L2
11	Components and hydraulic circuit design ComponentsClassification of control valves, Directional Control Valves-symbolic representation,	CO6	L2
12	Constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valvesPressure control valves - types, direct operated types and pilot operated types. Flow Control Valves -compensated and non-compensated FCV,	CO6	L2
13	Needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV,	CO6	L2
c	**Application Areas**	**CO**	**L3**
1	Small and medium automation	CO5	L2
2	Academic demonstration	CO6	L2
d	**Review Questions**	-	
1	Sketch and explain Needle valve	CO5	L2
2	Sketch and explain temperature compensated, pressure compensated valve	CO5	L2
3	Sketch and explain Control of single and Double -acting hydraulic cylinder	CO5	L2
4	Sketch and explain cylinder synchronizing circuit	CO5	L2
5	Sketch and explain Hydraulic Circuit examples with accumulator.	CO5	L2
6	Explain Speed control of hydraulic cylinder- metering in, metering out	CO5	L2
	Explain Hydraulic circuit for force multiplication	CO6	L2
8	Sketch and explain Bleed off circuits. Pilot pressure operated circuits	CO6	L2
9	Sketch and explain Hydraulic cylinder sequencing circuits,	CO6	L2
10	Sketch and explain Directional Control Valves-symbolic representation,	CO6	L2
e	**Experiences**	-	-
1			
2			
3			
4			
5			

Module – 4

Title:	Pneumatic power systems	Appr Time:	16 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to understand :	-	**Level**
1	Pneumatic power system		L2

2	Interpreting circuit		L2
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Introduction to Pneumatic systems:Pneumatic power system,	CO7	L2
2	Advantages, limitations, applications, Choice of working medium.	CO7	L2
3	Characteristics of compressed air and air compressors.	CO7	L2
4	Structure of pneumatic control System	CO7	L2
5	Fluid conditioners-dryers and FRL unit.	CO7	L2
6	Pneumatic Actuators:Linear cylinder – types of cylinders, working	CO7	L2
7	End position cushioning, seals, mounting arrangements, and applications.	CO8	L2
8	Rotary cylinders- types, construction and application, Symbols.	CO8	L2
9	Pneumatic Control Valves:DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction	CO8	L2
10	Use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols	CO8	L2
c	**Application Areas**	**CO**	L2
1	Small and medium automation	CO8	L2
2	Academic demonstration	CO7	L2
d	**Review Questions**	-	
1	Sketch and explain Rod less type of air cylinder?	CO7	L2
2	Explain with a neat sketch, working of balanced vane motor	CO7	L2
3	Explain with a neat sketch, working of swash plate piston motor	CO8	L2
4	A hydraulic motor has volumetric efficiency of 90%and operates at 1750 rpm and pressure of 6.9 Mpa if the actual flow of the motor is 285 lpm and actual torque of the motor is 147Nm find the overall efficiency	CO7	L3
5	Sketch and explain simple pneumatic system ?	CO8	L2
6	Write a short note on cylinder mounting arrangement and it's type	CO8	L2
7	State the advantages of an pneumatic system?	CO8	L2
8	Explain with a neat sketch, working of Double acting pneumatic cylinder	CO8	L2
9	Write a note on characteristics if compressed air? Sketch and explain turbine type air motor	CO8	L2
10	Explain the use of memory valve		
e	**Experiences**	-	-
1			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:		15ME72	Sem:	VII	Marks:	15	Time:	75 minutes		
Course:		Fluid power system								
-	-	**Note: Answer any 2 questions, each carry equal marks.**						**Marks**	**CO**	**Level**
1	a	State the advantages of an pneumatic system?						5	CO5	L2
	b	Explain with a neat sketch, working of Double acting pneumatic cylinder						5	CO5	L2
	c	Write a note on characteristics if compressed air? Sketch and explain turbine type air motor						5	CO6	L2
2	a	A hydraulic motor has volumetric efficiency of 90%and operates at 1750 rpm and pressure of 6.9 Mpa if the actual flow of the motor is 285 lpm and actual torque of the motor is 147Nm find the overall efficiency						5	CO6	L2
	b	Sketch and explain simple pneumatic system						5	CO6	L2

	c	Write a short note on cylinder mounting arrangement and it's type	5	CO7	L2
3	a	Sketch and explain Rod less type of air cylinder?	5	CO7	L2
	b	Explain with a neat sketch, working of balanced vane motor	5	CO7	L2
	c	Explain with a neat sketch, working of swash plate piston motor	5	CO8	L2
4	a	Characteristics of compressed air and air compressors.	5	CO8	L2
	b	Structure of pneumatic control System	5	CO8	L2
	c	Fluid conditioners-dryers and FRL unit.	5	CO8	L2

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	15ME72	Sem:	VII	Marks:	5	Time:	180MINS
Course:	Fliud power system						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1		Sketch and explain Rod less type of air cylinder	5	CO7	L2
2		Explain with a neat sketch, working of balanced vane motor	5	CO7	L2
3		Explain with a neat sketch, working of swash plate piston motor	5	CO7	L2
4		Characteristics of compressed air and air compressors.	5	CO8	L2
5		Structure of pneumatic control System	5	CO8	L2
6		Fluid conditioners-dryers and FRL unit.	5	CO8	L2
7		State the advantages of an pneumatic syste	5	CO8	L2
8		Explain with a neat sketch, working of Double acting pneumatic cylinder	5	CO7	L2
9		Write a note on characteristics if compressed air? Sketch and explain turbine type air motor	5	CO7	L2
10		A hydraulic motor has volumetric efficiency of 90%and operates at 1750 rpm and pressure of 6.9 Mpa if the actual flow of the motor is 285 lpm and actual torque of the motor is 147Nm find the overall efficiency	5	CO7	L2
11		Sketch and explain simple pneumatic system	5	CO7	L2
12L3		Explain the control of single acting cylinder	5	CO8	L2
13		Explain the constructional features of poppet valve	5	CO8	L2
14		Give the classification fcv's and explain any 2 in detail	5	CO8	L2
15		Explain with a neat sketch pressure compensated FCV	5	CO8	L2
16		Explain with a neat sketch temperature compensated FCV	5	CO8	L2
17		List the symbolic representations of FCV's	5	CO8	L2
18		Explain with a neat sketch Regenerative circuit	5	CO8	L2
19		Explain with a neat sketch pump unloading circuit	5	CO8	L2
20		List out the applications of pneumatic systems	5	CO8	L2
21		Explain with a neat sketch Regenerative circuit	5	CO8	L2
22		Explain cylinder synchronizing circuit using different methods	5	CO8	L2
23		Explain hydraulics circuits for cylinder force multiplication	5	CO8	L2
24		With a neat sketch explain Metering out circuit	5	CO8	L2
25		Explain quick pressure control valve	5	CO8	L2
26		Explain with a neat sketch explain construction of flow control valve	5	CO8	L2
27		Explain with a neat sketch time delay valve	5	CO8	L2
28		Explain with a neat sketch twin pressure valve	5	CO8	L2
29		List the advantages and dis advantages of pneumatics systems	5	CO8	L2
30		What do you mean by rotary valve explain any 2 types	5	CO8	L2
31		Explain with a neat sketch counter balance valve application	5	CO8	L2
32		Write a short note on cylinder mounting arrangement and it's type	5	CO7	L2

D3. TEACHING PLAN - 3

Module – 5

Title:	Pnuematic control circuits	Appr Time:	16 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to understand :	-	**Level**
1	Familiarize with logic controls	5	L2
2	Troubleshooting	5	L2
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Simple Pneumatic Control:Direct and indirect actuation pneumatic cylinders,speed control of cylinders - supply air throttling and exhaust	CO9	L2
2	Signal Processing Elements:	CO9	L2
3	Multi- Cylinder Application:Coordinated and sequential motion control,	CO9	L2
4	Control:Principles - signal input and output, pilot assisted solenoid control of directional control	CO9	L2
5	Signal elimination methods, Cascading method principle, Practical application	CO9	L2
6	Air throttling. Valves, use of relay and contactors.	CO10	L2
7	Control circuitry for simple signal cylinder application	CO10	L2
8	Use of Logic gates - OR and AND gates in pneumaticApplications.	CO10	L2
9	Motion and control Diagrams. Electro- Pneumatic	CO10	L2
10	Practical examples involving the use of logic gates	CO10	L2
			L2
c	**Application Areas**	**CO**	**L2**
1	Actuator company (FESTO)	CO10	L2
2	Design department	CO9	L2
			L2
d	**Review Questions**	-	L2
1	Sketch and explain any 5 symbolic representation of DCV'S	CO9	L2
2	Explain with a neat sketch Pressure relief valve.	CO9	L2
3	State the function of Flow control valve & explain with a neat sketch Needle valve	CO9	L2
4	Explain with a neat sketch Pressure compensated valve	CO9	L2
5	Explain with a neat sketch different types of valve actuation methods	CO9	L2
6	Explain with a neat sketch solenoid-actuated DCV.	CO9	L2
7	Sketch and explain Regenerative circuit. What do you mean by speed control of hydraulic cylinder?	CO10	L2
8	What is accumulator? Give the classification of accumulators.	CO10	L2
9	Explain the circuit of an accumulator as a leakage compensator.	CO10	L2
10	What is meant by cylinder synchronizing circuit? Explain cylinder in series circuit.	CO10	L2
11	Sketch and explain speed control of a hydraulic motor?	CO10	L2
e	**Experiences**	-	-
1			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	15ME72	Sem:	VII	Marks:	15	Time:	75 minutes
Course:	Fluid power systems						

-	-	**Note: Answer any 2 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	Explain the circuit of an accumulator as a leakage compensator.	5	CO9	L2
	b	What is meant by cylinder synchronizing circuit? Explain cylinder in series circuit.	5	CO9	L2
	c	Sketch and explain speed control of a hydraulic motor?	5	CO9	L2

2	a	Explain with a neat sketch solenoid-actuated DCV.	5	CO9	L2
	b	Sketch and explain Regenerative circuit. What do you mean by speed control of hydraulic cylinder?	5	CO9	L2
	c	What is accumulator? Give the classification of accumulators.	5	CO10	L2
3	a	State the function of Flow control valve & explain with a neat sketch Needle valve	5	CO10	L2
	b	Explain with a neat sketch Pressure compensated valve	5	CO10	L2
	c	Explain with a neat sketch different types of valve actuation methods	5	CO10	L2
4	a	Sketch and explain any 5 symbolic representation of DCV'S	5	CO10	L2
	b	Explain with a neat sketch Pressure relief valve.	5	CO10	L2

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	15ME72	Sem:	VII	Marks:	5 / 10	Time:	180 minutes
Course:	Fluid power systems						

Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.

SNo	USN	Assignment Description	Marks	CO	Level
1		Sketch and explain any 5 symbolic representation of DCV'S	5	CO9	L2
2		Explain with a neat sketch Pressure relief valve.	5	CO9	L2
3		State the function of Flow control valve & explain with a neat sketch needle valve	5	CO9	L2
4		Explain with a neat sketch Pressure compensated valve	5	CO9	L2
5		Explain with a neat sketch different types of valve actuation methods	5	CO9	L2
6		Explain with a neat sketch solenoid-actuated DCV.	5	CO9	L2
7		Sketch and explain Regenerative circuit. What do you mean by speed control of hydraulic cylinder?	5	CO10	L2
8		What is accumulator? Give the classification of accumulators.	5	CO10	L2
9		Explain the circuit of an accumulator as a leakage compensator.	5	CO10	L2
10		What is meant by cylinder synchronizing circuit? Explain cylinder in series circuit.	5	CO10	L2
11		Sketch and explain speed control of a hydraulic motor?	5	CO10	L2
12		hydraulic motor has a displacement of 150 cm3, operates with a pressure of 75 bar andspeed of 1800 rpm. If the actual flow rate consumed by the motor is 0.005 m3/sec and the actual torque delivered by the motor is 165 N-m. Find (i) Volumetric efficiency (ii) Mechanical efficiency (iii) The actual power delivered by the motor.	10	CO10	L2
13		Explain the different methods of actuations.	5	CO9	L2
14		Why speed controllers in cylinders is needed explain	5	CO9	L2
15		Explain exhaust air throttling	5	CO9	L2
16		List out the different signal processing elements	5	CO9	L2
17		Explain the working principles of OR Gates in pneumatic applications	5	CO9	L2
18		Explain the working principle of AND Gates in pneumatic application	5	CO9	L2
19		Explain the practical examples involving the use of logic gates	5	CO9	L2
20		What do you mean by multi cylinder application,explain	5	CO9	L2
21		Differentiate between coordinated and sequential motion control	5	CO9	L2
22		Explain any one signal elimination methods	5	CO9	L2
23		What do you mean by cascading method	5	CO9	L2
24		Explain the principal behind reversing valves	5	CO9	L2
25		Explain electro pneumatic control systems in detail	5	CO9	L2
26		Explain pilot assisted solenoid control of DCV's	5	CO9	L2
27		Explain the use of relays and contactors in pneumatic control systems	5	CO9	L2
28		List out the application of pneumatic systems	5	CO9	L2
29		Explain with practical examples involving the use of logic gates	5	CO9	L2

30		With a neat sketch explain the working of linear actuator for single acting cylinder	5	CO10	L2

F. EXAM PREPARATION

1. University Model Question Paper

Course:		Fluid power systems					Month / Year	Dec /2018	
Crs Code:		15ME72	Sem:	VII	Marks:	80	Time:	180 minutes	
-	**Note**	Answer all FIVE full questions. All questions carry equal marks.					**Marks**	**CO**	**Level**
1	a	State Pascal's law. Explain with neat sketch the basic hydraulic system with respect to forces and pressure in an enclosed tank					10	CO1	L2
	b	With a neat sketch, Explain the working of a pressure compensated variable displacement hydraulic vane pump					5	CO1	L2
	c	Write short notes on: i) Reservoir system ii) Filters					5	CO1	L2
	d	What are the different problems arises in the hydraulic system and also mention the remedies					10	CO1	L2
		OR							
	a	List six desirable properties of hydraulic fluid and explain any three properties					5	CO2	L2
-	b	Discuss the problems caused by the gases in hydraulic fluids					5	CO2	L2
	c	With a neat sketch explain pressure switch					5	CO2	L2
	d	State and explain widely used types of seals in hydraulic systems					5	CO2	L2
		OR							
2	a	A vane pump has a volumetric displacement of 90 $cm^{3.}$ It has rotor dia of 5 cm and cam ring dia of 7.5 cm and a vane width of 5 cms. What must be the eccentricity					10	CO2	L2
	b	Explain the mechanism of hydraulic loading					5	CO3	L2
	c	A hydraulic motor has a displacement of 130cm^3 operates with a pressure of 105 bars & at a speed of 2000rpm.if actual flow rate is 0.005m^3/s and actual torque delivered by motor is 200n-m find Volumetric efficiency, Mechanical efficiency and overall efficiency					10	CO3	L2
	d	With a neat sketch explain 1^{st} ,2^{nd} class lever systems					6	CO3	L2
		OR							L2
	a	Explain the mechanism of 1^{st} class loading mechanism					5	CO4	L2
	b	State the advantages of an pneumatic system?					5	CO4	L2
	c	Explain with a neat sketch, working of balanced vane motor					8	CO4	L2
	d	Sketch and explain simple pneumatic system. also write a short note on cylinder mounting arrangement and it's types					6	CO4	L2
		OR							
3	a	Sketch and explain Rod less type of air cylinder?					5	CO5	L2
	b	Explain with a neat sketch, working of balanced vane motor					8	CO5	L2
	c	Explain with a neat sketch, working of swash plate piston motor					8	CO5	L2
	d	Explain with a neat sketch, working of unbalanced vane motor					8	CO5	L2
		OR							
	a	Sketch and explain simple pneumatic system ?					5	CO6	L2
	b	Write a short note on cylinder mounting arrangement and it's type					5	CO6	L2
	c	State the advantages of an pneumatic system?					5	CO6	L2
	d	Explain with a neat sketch, working of Double acting pneumatic cylinder					5	CO6	L2
4	a	Write a note on characteristics if compressed air? Sketch and explain turbine type air motor					5	CO7	L2

	b	A hydraulic motor has volumetric efficiency of 90%and operates at 1750 rpm and pressure of 6.9 Mpa if the actual flow of the motor is 285 lpm and actual torque of the motor is 147Nm find the overall efficiency	10	CO7	L2
	c	Sketch and explain simple pneumatic system ?	5	CO7	L2
	d	Write a short note on cylinder mounting arrangement and it's type	5	CO7	L2
		OR			
	a	Sketch and explain Rod less type of air cylinder?	5	CO8	L2
	b	Explain with a neat sketch, working of balanced vane motor	8	CO8	L2
	c	Explain with a neat sketch, working of swash plate piston motor	8	CO8	L2
	d	Characteristics of compressed air and air compressors.	5	CO8	L2
5	a	Structure of pneumatic control System	5	CO9	L2
-	b	Explain Fluid conditioners-dryers and FRL unit.	7	CO9	L2
	c	State the advantages of an pneumatic system?	5	CO9	L2
	d	Explain with a neat sketch, working of Double acting pneumatic cylinder	5	CO9	L2
		OR			
	a	Write a note on characteristics if compressed air? Sketch and explain turbine type air motor	5	CO10	L2
	b	Explain with a neat sketch, working of air pump	5	CO10	L2
	c	Sketch and explain simple pneumatic system ?	6	CO10	L2
	d	Write a short note on cylinder mounting arrangement and it's type	5	CO10	L2

2. SEE Important Questions

Course:		Fluid power systems					Month / Year	Dec /2018	
Crs Code		15ME72	Sem:	VII	Marks:	80	Time:	180 minutes	
	Note	Answer all FIVE full questions. All questions carry equal marks.					-	-	
Module	Qno.						**Marks**	**CO**	**Year**
1	1	Write any five desirable properties of a hydraulic fluid.					5	Co1	2018
	2	Explain three basic types of filtering methods used in hydraulic system					6	CO1	2018
	3	Explain static seals and dynamic seals with examples.					5	CO1	2018
	4	Identify the most common causes of hydraulic system break down.					4	CO1	2018
2	1	With a neat block diagram, explain the structure of hydraulic power system.					5	co2	2018
	2	A gear pump has a 75 min outside diameter, a 50 mm inside diameter and a 25 mm width. If the volumetric efficiency is 90% at rated pressure, what is the corresponding actual flow rate? The pump speed is 1000 rpm.					10	co2	2018
	3	What are the advantages of hydraulic system?					5	co2	2018
	4	A pump has a displacement volume of 100 cm3. it delivers 0.0015 m3/s at 1000 rpm and 70 bars. If the prime mover input torque is 120 NAIL Determine (i)What is the overall efficiency of the pump? (ii)What is the theoretical torque required to operate the pump?					08	co3	2018
3	1	Explain with neat sketch of — Poppet valve with symbolic representation.					5	co3	2018
	2	Explain with neat sketch of pilot operated pressure Relief valve					7	co3	2018
	3	Explain with a neat sketch the working of shuttle valve with symbolic representations					5	co3	2018
	4	Define accumulator and explain any 2 types					3	co3	2018
4	1	Write a brief note on OR and AND gates with symbol of these switches.					5	co4	2018
	2	Explain with neat sketch of circuit of sequencing of two pneumatic cylinder that can be done by using Solenoids, limit switches and valves.					5	co4	2018
	3	Explain with a neat sketch poppet valve					4	co4	2018
	4	Explain with a neat sketch the construction of FCV					6	co4	2018
5	1	State five disadvantages of using air instead of hydraulic oil.					5	co5	2018
	2	Explain with schematic sketch of FRL unit with ANSI symbol.					5	co5	2018
	3	Explain the characteristics of compressed air.					5	co5	2018
	4	Explain any one signal elimination method					5	co5	2018

G. Content to Course Outcomes

1. TLPA Parameters

Table 1: TLPA – Example Course

Module- #	Course Content or Syllabus (Split module content into 2 parts which have similar concepts)	Content Teaching Hours	Blooms' Learning Levels for Content	Final Blooms' Level	Identified Action Verbs for Learning	Instruction Methods for Learning	Assessment Methods to Measure Learning
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1	Introduction to fluid power systems, components, advantages and applications. Transmission of power at static and Dynamic states. Pascal's law and its applications. Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and Pressure on hydraulic fluid.	10	L2	L2	- Understand	Chalk and Board	Assignment - 1
1	Seals, sealing materials, Compatibility of seal with fluids. Pressure drop in hoses/pipes. Heat exchangers. Control heat exchangers. Types of pipes, Hoses and quick acting couplings. Fluid conditioning through filters, Strainers; sources of contamination and contamination	10	-L2	L2	-Analyze	Chalk and Talk	Assignment-1
2	Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps Fixed,Pump performance characteristics, pump selection factors procedure Problems on pumps. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor. Cost estimation of mechanical process, idling time.	10	-L2	L2	Understand	Chalk and Board	Assignment-1
2	Actuators:Classification cylinder and hydraulic motors, Hydraulic cylinders, single acting cylinder Mounting arrangements, cushioning, special types of cylinders, problems on cylinders. Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flow rate, andhydraulic motor performance; numerical problems. Symbolic representation of hydraulic actuators (cylinders and motors).	10	-L2	L2	Analyze	Chalk and Board	Assignment-1
3	Components and hydraulic circuit design Components:Classification of control valves, Directional Control Valves-symbolic representation, Constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valves Pressure control valves - types, direct operated types and pilot operated types. Flow Control Valves - compensated and non- compensate d FCV, Needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV.	10	-L2	L2	- Understand	Chalk and Board	Assignment-2
3	Design: Control of single andDouble -acting hydraulic cylinder, regenerative circuit, pump unloading circuit, Double pump hydraulic system, counter balance valve application,	12	- L2	L2	Analyse	Chalk and Board	Assignment 2

	Hydraulic cylinder sequencing circuits, cylinder synchronizing circuit Hydraulic circuit for force multiplication Speed control of hydraulic cylinder-metering in, metering out Bleed off circuits. Pilot pressure operated circuits Hydraulic Circuit examples with accumulator.						
4	Introduction to Pneumatic systems:Pneumatic power system, Advantages, limitations, applications, Choice of working medium. Characteristics of compressed air and air compressors. Structure of pneumatic control System Fluid conditioners-dryers and FRL unit. Pneumatic Actuators: Linear cylinder – types of cylinders, working End position cushioning, seals, mounting arrangements, and applications.	8	- L2	L2	- Understand	Chalk and Board	Assignment 2
4	Pneumatic Actuators: Linear cylinder – types of cylinders, working End position cushioning, seals, mounting arrangements, and applications. Rotary cylinders- types, construction and application, Symbols. Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction Use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols.	8	- L2	L2	-Analyse	- Lecture - Tutorial -	- Assignment -2
5	Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust air throttling. Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications.Practical examples involving the use of logic gates.	5	- L2	L2	- Understand	Chalk and Board	- Assignment -3 -
5	Multi- Cylinder Application: Coordinated and sequential motion control, motion and control diagrams. Signal elimination methods, Cascading method- principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves). Electro- Pneumatic Control: Principles - signal input and output, pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple signal cylinder application.	5	- L2	L2	-Analyze	Chalk and Board	- Assignment -3 -

2. Concepts and Outcomes:

Table 2: Concept to Outcome – Example Course

Module- #	Learning or Outcome from study of the	Identified Concepts from	Final Concept	Concept Justification (What all Learning Happened from the	CO Components (1.Action Verb, 2.Knowledge,	Course Outcome

	Content or Syllabus	Content		study of Content / Syllabus. A short word for learning or outcome)	3.Condition / Methodology, 4.Benchmark)	**Student Should be able to ...**
A	*I*	*J*	*K*	*L*	*M*	*N*
1	Understand and analyze fluid power and modes	Fluid power	Hydraulics Power	Comprehend the working of fluid power	- Understand fluid power system	Understand the working of fluid power systems
1	Select components as per circuitry requirement	Components		Knowledge about different components	- Analyze - features of components	Understand about different components available
2	fluid dynamics	Mechanism	Working principles	Understanding about valve mechanisms	- Analyze - working mechanisms	Understand concept and relationships of force,pressure and energy.
2	Programmable controllers	Features		Understanding about valve constructional features	- Understand - different flowing capacities	Understand the constructional and working of valves
3	Analyses the working of components	Components	Circuits	Have knowledge of working of components	- Analyze - features of components	Analyse different components in the circuits
3	Build the circuit for certain applications	Circuits		Comprehend the working of hydraulic circuits	- Apply - building of circuits	Understand the working of circuit for certain applications
4	Pneumatic power system	Pneumatic systems	Pneumatic System	Comprehend the working of pneumatic system- Understand fluid power system	Comprehend the working of pneumatic power	Understand the working of pneumatic systems
4	Interpreting circuit	Circuits		Comprehend the working of pnuematic circuit	- Apply - building of circuits	Analyze the working of pnuematic circuits
5	Familiarize with logic controls	Actuation	Logic control	Explain the working of different actuation methods	- Understand different actuation methods and modes	Analyse the different methods of actuation in the circuits
5	Troubleshooting	Integration		Synchronizing of circuit with different components in circuits	- Understand the communication between the working of components	Build the circuit and analyze the working of different components in circui