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Diploma in Mechatronics Engineering
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COURSE CODE	CATE-GORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTMT401	DCC	Introduction to Robotics	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives(CEOs):

1. To make students understand the fundamentals of Robotics.
2. To provide overview of sensors involved in designing of Robots.
3. To give students knowledge of effectors.

Course Outcomes(COs):

After completion of the course, students will able to:

1. Understand the concept of robotic and its applications in engineering.
2. Formulate the mathematical relations for forward and inverse kinematic analysis and trajectory generation of robotic manipulator.
3. Determine forces at end effector and select the actuator and sensor for a robot in a specific job task.

Syllabus

UNIT I **7 Hrs.**

Robot technology Fundamentals of Robots: Introduction, fundamentals of robot technology, classification, applications, Systems overview of a robot, basic components, control system and components.

UNIT II **8 Hrs.**

Robot motion analysis and control Robot arm kinematics, forward & inverse kinematics solutions, Trajectory design, Introduction to robot arm dynamics, introduction to mobile robots.

UNIT III **7 Hrs.**

Actuators and sensors in Robot AC/DC motors, stepper motors and servo motor, Internal sensors, Position, Velocity, Acceleration, Proximity sensors, Touch and Slip sensors, Force and Torque sensors.

UNIT IV **7 Hrs.**

External sensors, contact and non-contact type like Vision, ranging, laser, acoustic, tactile etc. sensor selection and control.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTMT401	**DCC**	**Introduction to Robotics**	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT V **8 Hrs.**

Robot end effectors, types of end effectors, mechanical grippers, other types of grippers, tools as end effectors, robot end effector interface, gripper selection and design.

.Text Books:

1. Richard D. Klafter, Thomas A Chmielewski and Michael Negin, "Robotics Engineering: An integrated approach", Prentice Hall ,Reprint 2020.
2. Mittal and Nagrath , "Robotics & Control ", Tata McGraw-Hill Publishing Company Ltd., New Delhi ,2003.

References:

1. John Craig , "Introduction to Robotics, mechanics and control", Pearson Education, New Delhi,2004.
2. Mikell P Groover, Mitchel Weiss, "Industrial Robotics: Technology, programing and applications" McGraw Hill education, 2nd edition, 2012.

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTMT303	DCC	Analog Electronics	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

1.To understand the basic operation of BJT.
2.To learn biasing techniques of BJT
3.To Understand small signal analysis of Transistor.
4.To understand basic operation of FET.
5.To learn concept of Feedback.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate followingknowledge, skills, and attitudes.

The students will be able to

1.To explain the operation of BJT and FET.
2.To demonstrate and analyze biasing technique of BJT.
3.To demonstrate small signal analysis of Transistor.
4.To explain concept of feedback.

Syllabus

UNIT I **8 Hrs.**

Bipolar-junction transistor: basic operation, current components and equations, CB, CE and CC configuration, input and output characteristics, Early effect, Region of operations: active, cut-off and saturation region. BJT as an amplifier.

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DTMT303	DCC	Analog Electronics	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT II **9 Hrs.**

The DC and AC Load lines, Need for Biasing, Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector-Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Thermal Runaway, Thermal Stability.

UNIT III **8 Hrs.**

Small Signal analysis: small signal Amplifier, Amplifier Bandwidth, Hybrid model, analysis of transistor amplifier using h-parameter, Multistage Amplifier: Cascading amplifier, Boot-strapping Technique, Darlington amplifier and Cas-code amplifier.

UNIT IV **6 Hrs.**

Introduction of JFETs, Transfer Characteristics, Depletion type MOSFET, Enhancement type MOSFET.

UNIT V **6 Hrs.**

Concept of Feedback: Positive feedback, Negative Feedback, Transfer characteristics,Application of positive and negative feedback, characteristics, and advantages of negative feedback.

Text Books:

1. J. Millman and Christos C. Halkias, "Integrated Electronic", 1991Ed., 2008, TMH.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits", 9 Ed., 2006, PEI/PHI.

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DTMT303	**DCC**	**Analog Electronics**	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

References:

1. S.Salivahanan, N.Suresh Kumar, A.Vallavaraj, "Electronic Devices and Circuits", 2nd Edition, 2008, TMH.
2. B. P. Singh, Rekha Singh, "Electronic Devices and Circuits", Pearson, 2nd Edition, 2013.

List of Experiments:

1. To demonstrate the input /output characteristics of Common base configuration.
2. To demonstrate the input /output characteristics of Common Emitter configuration.
3. To demonstrate the input /output characteristics of Common Collector configuration.
4. To perform AC, DC analysis.
5. To analyze Fixed bias.
6. To demonstrate Transfer characteristics of FET.
7. To study concept of Feedback.
8. To analyze transfer characteristic of negative feedback.
9. To analyze transfer characteristic of positive feedback.
10. To study application of negative feedback.

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DTMEMT403	DCC	Fluid Power Engineering	60	20	20	30	20	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

Understand the properties of fluid, Components of fluid power system, Engineering application of hydraulic and pneumatic systems

Course Outcomes (COs):

1. Learn the benefits and limitations of fluid power compared with other power transmission technologies.
2. Understand the operation and use of different hydraulic machines like hydraulic crane, fluid coupling and fluid torque convertor etc.
3. Formulate and analyze models of hydraulic components.
4. Design and predict the performance of fluid power components.

Syllabus

UNIT I **7 Hrs.**

Fluid Properties: Properties of fluids: Density, specific gravity, specific weight, specific volume, pressure, absolute pressure, gauge pressure, Kinetic viscosity, absolute viscosity, Capillarity, surface tension. PASCAL's law and Bernoulli's theorem, applications of Bernoulli's theorem.

UNIT II **7 Hrs.**

Impact of Jet: Introduction, Force exerted on stationary plate held normal and inclined to jet, Force exerted on curved plate, force exerted on moving plate held normal and inclined in direction of moving jet, Force on a plate when vane is moving in direction of jet, jet striking on curved vane tangentially at one tip and leaving at other end, jet propulsion in ships.

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTMEMT403	DCC	Fluid Power Engineering	60	20	20	30	20	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT III **9 Hrs.**

Hydraulic Turbines: Introduction, Classification of turbines, Impulse and reaction turbines; construction, working and performance of Pelton, Francis, and Kaplan Turbines; Draft tubes-types and construction; concept of cavitation in turbines; Calculation of Work done, Power and efficiency of turbine.

UNIT IV **10 Hrs.**

Centrifugal Pumps: Pump classification and selection criterion, Centrifugal pumps, Velocity vector diagrams, Pump losses and efficiencies, Net positive suction head, Pressure rise in impeller, Characteristic curves of centrifugal pumps, priming, maximum suction limit - minimum starting speed to deliver the discharge, Multistage pumps, cavitation, pump selection.
Reciprocating Pumps: Operation of Reciprocating pumps, discharge co-efficient, volumetric efficiency, slip, work done, and power required to drive reciprocating pumps

UNIT V **9 Hrs.**

Reciprocating Compressors: Construction and working, Multistage conditions for minimum work, Intercooling, Efficiency and control of air compressors.
Rotary Compressors: Introduction, Classification, roots blower, Vane type, Screw compressor, Scroll compressor.
Centrifugal Compressors: Essential parts, Static and total head properties, Velocity diagram, Degree of reaction, surging and choking, Losses in centrifugal compressor

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTMEMT403	DCC	Fluid Power Engineering	60	20	20	30	20	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Text Books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria & Sons.
2. Fluid Power Engineering by R.N. Patel and V.L. Patel Mahajan Publication
3. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan.
4. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.

References:

1. Fluid Mechanics by Victor L. Streeter, Benjamin Wylie Ninth, 2004.
2. Fluid Mechanics by Frank M. White, 2000.
3. Turbines, Compressors and Fans by S.M. Yahya., TMH Publishers
4. Fluid Mechanics by Yunus A. Cengel, John M. Cimbala, 2007.

List of Experiments:

1. Performance test on Pelton turbine.
2. Performance test on Kaplan turbine.
3. Performance test on Francis turbine.
4. Performance test on Centrifugal pump.
5. Performance test on Reciprocating pump
6. Performance test on Centrifugal compressor.
7. Performance test on Reciprocating compressor.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTMT403	SEC	Software Lab	0	0	0	30	20	0	0	2	1

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
1. To understand the basics of MATLAB software.
2. To Perform various operation on MATLAB.

Course Outcomes (COs): After completion of this course the students will be able:
1. To explain the basics of MATLAB.
2. To solve various operation on MATLAB.

Syllabus

List of Experiments:
1. Study of MATLAB Software.
2. To study and perform Matrix operation.
3. To solve linear equation.
4. To solve differential equation in MATLAB.
5. To solve Integral Equation in MATLAB.
6. To Study building blocks of Simulink in MATLAB.
7. To make Half adder using Simulink.
8. To make Full adder using Simulink.
9. To make Half subtractor using Simulink.
10. To make Full subtractor using Simulink.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTMT403	**SEC**	**Software Lab**	0	0	0	30	20	0	0	2	**1**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Text Books:

1.Amos Gilat,"MATLAB: An Introduction with Applications:, 4ed ,Wiley, 2012.
2.Stephen J. Chapman ,"MATLAB Programming for Engineers", 6E , Cengage, 2019.

References:

1.Rudra Pratap, "Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers", Oxford University Press, 2010.

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DTMT402	DCC	Hydraulic and Pneumatic Systems	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives(CEOs):
The subject aims to provide the student with:
1. Understanding of Hydraulic and Pneumatic system fundamental.
2. Understanding of fluid types.
3. Understanding of principle of pneumatic valves.

Course Outcomes (COs):
After completion of course student will be able to :
1. Explain concept of Hydraulic and Pneumatic system.
2. Able to workout designing of various hydraulic pneumatic circuits.

Syllabus

UNIT I **8 Hrs.**

Fluid- Concept and classification of fluid-Newton's law viscosity-Properties of fluid Density, Specific gravity, Specific Weight, Specific Volume- Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility-Fluid pressure, Pressure head, Pressure intensity-Concept of absolute vacuum, gauge pressure, atmospheric Pressure-pressure,- Simple and differential manometers, Bourdon pressure gauge.

UNIT II **9 Hrs.**

Fluid flow Types of fluid flows,Continuity equation,Bernoulli's theorem,Venturi meter, Construction, principle of working, Coefficient of discharge, Discharge through venture meter, Orifice meter-Pitot tube , Construction, Principle of working, hydraulic coefficients ,Numerical on Bernoulli's theorem, venturi meter, orifice meter.

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DTMT402	DCC	Hydraulic and Pneumatic Systems	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT III **7 Hrs.**

Concepts of fluid friction- Loss of head due to friction- Minor losses in pipes -Darcy's equation and Chezy's equation for frictional losses, Hydraulic gradient and total gradient line. Hydraulic power transmission through pipe- Numerical to estimate Loss of head due to friction and major and minor losses- Power transmission. Concept of water hammer in pipes.

UNIT IV **10 Hrs.**

Pneumatic system, General layout of pneumatic system, Advantages of pneumatic systems Components of pneumatic system- Compressor, Reciprocating.-construction and working of FRL unit-working and symbols of Control Valves.

UNIT V **10 Hrs.**

Pressure regulating valves, Flow Control valves, Direction Control Valves, Actuators , Cylinders, single acting and double acting , Air motors, piston motor-unit, Pneumatic Symbols, ports and positions.

Text Books :

1.Bansal. R.K.,"Fluid Mechanics and Hydraulics Machines", 9th Edition, Laxmi Publications Pri vate Limited, New Delhi. 2011.

2. R.S.Khurmi, "Fluid Mechanics and Machinery",S.Chand and Company, 2nd Edition, 2007

3. Hydraulics & Pneumatics – Andrew Parr, Jaico Publishing House New Delhi.

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DTMT402	**DCC**	**Hydraulic and Pneumatic Systems**	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

References:

1. Ramamritham. S, "Fluid Mechanics, Hydraulics and Fluid Machines", Dhanpat Rai & Sons, Delhi, 2004.
2. P. N Modi and S. M. Seth, "Hydraulics and Fluid Mechanics Including Hydraulics Machines", 19th Edition, Standard Book House, 2013.
3. Pneumatic And Pneumatics Controls -Understanding Made Easy - K.S.Sundaram,-S.chand Com pany Delhi 8. Pneumatic Systems - Majumdar, S.R. -Tata McGraw-Hill Publication, 3/e, 2013.

List of Experiments:

1. Study of Valve operations.
2. Designing of Hydraulic circuits on H-simulator.
3. Designing of Pneumatic circuits on P- simulator
4. To perform XY position on PLC trainer.
5. To study and perform conveyor system.
6. To design counter on PLC.
7. To design timer on PLC.
8. To perform and design circuit on Pneumatic station.
9. To perform and design circuit on pneumatic valves using PLC.
10. Case study of application of Hydraulic and Pneumatic system in Industries.

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Board of Studies
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