

GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme	Diploma Engineering				Branch	Mechatronics Engineering			
Semester	VI				Version	1.0.0.0			
Effective from Academic Year		2020-21			Effective for the batch Admitted in		July 2018		
Subject code	1MC2602		Subject Name		ROBOTICS				
Teaching scheme					Examination scheme (Marks)				
(Per week)	Lecture(DT)		Practical(Lab.)		Total	CE	SEE	Total	
	L	TU	P	TW					
Credit	3	0	1	0	4	Theory	40	60	100
Hours	3	0	2	0	5	Practical	30	20	50

Pre-requisites:
Course Learning Outcomes:
<p>The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes:</p> <ul style="list-style-type: none"> CO1. Evaluate degree of freedom and able to select right parameter for robot. CO2. Maintain the different types of robot sensors CO3. Distinguish servo and non-servo control. CO4. Operate robot through software. CO5. Troubleshoot minor problems. <p>The practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate course learning outcomes.</p>

Course Content				
Name of UNIT	Unit Content	Unit Learning Outcomes	Marks	Hrs
Unit – I Elements of Robot	1a. Explain the basic concept of robot. 1b. Explain the structure of manipulator. 1c. Classify different robotic systems. 1d. Evaluate degrees of freedom.	1.1 Robot-definition, need, brief history, social justification 1.2 Robot terminology, basic concepts, and key features 1.3 Robot anatomy. 1.4 Classification of robot according to: types of system, control loop, structure of manipulator(Cartesian, cylindrical, spherical, articulated) 1.5 Degree of freedom: concept measuring and importance.	10	6
Unit -II Robot Sensors	2a. Describe the end effector's types. 2b. Explain working of sensors used in robot. 2c. Differentiate between open loop and closed loop. 2d. Explain different robot configuration.	2.1 End effecters: types, sketches, working and applications 2.2 Drives: types and applications. 2.3 Sensing devices: Optical sensors, Proximity sensors, LVDT, Thermocouple, RTD, Thermistor, Force sensing – strain gauge,		

	2e. Select robot for suitable application.	piezoelectric, Acoustic sensing 2.4 Control systems : Open loop and close loop with applications and its elements 2.5 Robot configurations 2.6 Stand above, In-line, Cycle independent. 2.7 Selection criteria for robot 2.8 Robot machine vision	15	9
Unit-III Robotic Controls	3a. Explain the different level of control. 3b. Differentiate between servo and non-servo control. 3c. Explain various control techniques. 3d. Explain hardware which uses to control robot.	3.1 Need and scope of robot control 3.2 Levels of controls: Device controller, Work cell controller , Area controller, Plant host 3.3 Servo and non-servo control systems: Types, basic principles and block diagram. 3.4 Controlling methods: Types, Computed torque technique, new minimum time control, Variable structure control, Non-linear decoupled feedback control, resolved motion control, Adaptive control. 3.5 Electrical hardware. 3.6 programming languages 3.7 Controllers: Robot as work cell controller, Programmable logic controller, work cell control with local area networking, multiple network levels.	15	12
Unit-IV Introduction to Robot Programming	4a. Explain various robot programming languages. 4b. Simulate robot via software.	4.1 Need and functions of programming 4.2 Methods of robot programming: Manual Teaching, Lead through, Programming languages. Programming with graphics. 4.3 Programming languages: Types, features and applications. 4.4 Simulation for robot movements.	10	10
Unit- V Robotics Applications, Maintenance and Safety	5a. Explain general trouble shooting procedure. 5b. Explain safety norms. 5c. Describe maintenance procedure for robot.	5.1 Applications of robots (including special types) 5.2 Robot maintenance: Need types. 5.3 Common troubles and remedies in robot operation. 5.4 General safety norms, aspects and precautions in robot handling.	10	8

List of Practical		
No.	Unit	
1	1	Demonstrate configurations and anatomy of robots
2	2	Demonstrate robot end effectors
3	2	Demonstrate different types of sensor in robotics.
4	3	Control servo and non-servo system
5	4	Demonstrate operation of robot trainer kit.
6	4	Program a robot for golfer configuration.
7	4	Program a robot for thrower configuration
8	4	Program a robot for coffee maker configuration
9	4	Program a robot for draw bot configuration.
10	4	Program a robot for strider configuration
11	4	Design a robot for a given application and simulate the movement using simulation software.
12	5	Identify a fault in a given robot and prepare trouble shooting chart.

List of Instruments / Equipment / Trainer Board	
1	Programmable Robot trainer kit
2	Mechanical end effectors with servo control
3	Interfacing card(RC servo output, sensors input)
4	FreeWareSoftwares like RoboAnalyser, ROS, etc.

List of Reference Books			
No	Title of Reference Books	Authors	Publication
No.	Author	Title of Book	Publication
1.	KorenYoram	Robotics for Engineers	Tata McGraw - Hill Education,, New Delhi, 1st Edition
2.	Hedge G S	Textbook on Industrial Robotics	Laxmi Publications , New Delhi, 1st Edition
3.	GrooverMikell P.	Industrial Robotics: Technology, Programming, and Applications	McGraw Hill Education (India) Pvt Ltd, New Delhi, 2nd Edition
4.	Fu K. S.	Robotics	McGraw Hill Education , New Delhi, 1st Edition

Link of Learning Web Resource	
1	http://www.mtabindia.com/
2	http://www.robotics.org/
3	http://pcbheaven.com
4	http://www.servodatabase.com
5	https://www.youtube.com/watch?v=fH4VwTgfyRQ
6	https://www.youtube.com/watch?v=aW_BM_S0z4k