

## LESSON PLAN

<b>Subject Name-Robotics And Flexible Manufacturing Systems</b>	<b>Branch- Production Engineering</b>
<b>Subject Code-BPE 2802</b>	<b>Semester- 8<sup>th</sup></b>

<b>S/N</b>	<b>Module</b>	<b>Topic(s)</b>	<b>Period/Hours</b>
1.	I	Robot fundamentals: definitions, history of robots, laws of robots, robot specification, anatomy of robot	1
2.	I	Robot classification, function line diagram representation of robot arms, common types of arms.	2-3
3.	I	Robot end effectors- Types, Tools as end effectors,consideration in gripper selection and design.	4
4.	I	Robot application in manufacturing-Material transfer-Material handling, loading and unloading, processing-spot and continuous arc welding and spray painting.	5-6
5.	I	Manipulator Kinematics- Homogenous coordinate transformation,D-H representation of kinematics linkages, Forward and inverse kinematics of manipulators, Euler's angle.	7-9
6.	I	Differential transformation and manipulators, Jacobians.	10
7.	II	Robotics Dynamics: velocity kinematics, acceleration of rigid body, Lagrange Euler formulation. Robot actuators and sensors, internal and external sensors.	11-13
8.	II	Position –potentiometric, Optical sensors, Encoders-absolute, incremental touch and slip sensors	14
9.	II	Velocity acceleration sensors, Proximity sensors, force and torque sensors.	15
10.	II	Actuators- Hydraulic, Pneumatic and electrical, comparison of actuating systems and their relative merits and demerits.	16-18
11.	III	Robot Controllers: open and close loop control, manipulator control problem, linear control	19
12.	III	PD and PID control schemes, force and torque control in robotic manipulators.	20-23
13.	III	Robot Programming: Textual and lead through WAIT, SIGNALand DELAY commands.	24
14.	III	Capabilities and limitations of leadthrough programming, robot language structure.	25-27
15.	III	Motion, sensors and end efforts commands, Programming examples.	28

<b>S/N</b>	<b>Module</b>	<b>Topic(s)</b>	<b>Period/ Hours</b>
16.	IV	Flexible manufacturing systems: types of production, characteristics, applications, Flexibility in machining systems.	29-31
17.	IV	Need for FMS, Flexible automation, where to apply FMS technology.	32
18.	IV	Components of FMS- FMS layout configuration, Planning the FMS, workstations, Material Handling System, Automation Guided Vehicle systems.	33-36
19.	IV	Automated storage and retrieval systems, FMS layout configurations.	37-39
20.	IV	Application and benefits of FMS, problems in implementing FMS.	40