DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE THEORY - II

32082 – ROBOTICS

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32082

Semester : VI

Subject Title : ROBOTICS

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination				
	Hours/ Week	Hours/ Semester	Marks			Duration
Robotics	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	FUNDAMENTALS OF ROBOT TECHNOLOGY	14
II	ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS	14
III	SENSORS AND MACHINE VISION	14
IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	13
V	ROBOT APPLICATIONS IN MANUFACTURING	13
	REVISION AND TEST	7
	Total	**75**

RATIONALE:

Rapid industrialization and globalization needs industries to be more competitive and deliver cost effective quality products. This needs industries to

implement flexible manufacturing systems where Robotic technology plays major role. Hence study of robotic technology is very essential.

OBJECTIVES:

- Understand fundamentals of robotics
- Acquire knowledge structure and elements of robot
- Gain knowledge on controller and various drives used in robotics
- Develop knowledge on role of sensors and vision system
- Acquire skill to program and control robot
- Understand to adopt robot to various industrial applications.

ROBOTICS

DETAILED SYLLABUS

Theory contents:

Unit	Name of the Topic	Hours
I	**FUNDAMENTALS OF ROBOT TECHNOLOGY**	14
	Introduction – **History of robot** - Definitions-Robot Anatomy – Basic configuration of Robotics – Robot Components – Manipulator, End effecter, Driving system, Controller and Sensors. Mechanical arm – Degrees of freedom – Links and joints – Types of joints – Joint notation scheme – Pitch, Yaw, Roll – Classification of robots – Work envelope, Work Volume – Effect of structure on Control ,Work envelop and Work volume. Introduction to PUMA robot.	
II	**ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS**	14
	Robot controller – Configuration - Four types of controls – Open loop and closed loop controls – Speed of response and stability – Precision of movements: Spatial resolutions, accuracy and repeatability. Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – Stepper motors, DC Servo motors and AC Servo motors – Salient features – Applications and Comparisons of Drives. End effecters – Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Two fingered and	

Three fingered Grippers, Internal and External Grippers – End Of Arm Tooling (EOAT)- Selection and Design considerations.

III	SENSORS AND MACHINE VISION	14

Requirements of Sensors – **Sensor devices used in robot work cell** - Principles and applications of the following types of sensors – Position sensors: Piezo-electric sensors, LVDT, Resolvers, Optical encoders and Pneumatic position sensors – Range sensors – Proximity sensors: Inductive, Capacitive, Ultrasonic and Optical proximity sensors – Touch sensors: Binary sensors, Analog sensors – Wrist sensors – Slip sensors. Machine vision system – Camera – Frame grabber – Sensing and digitizing image data – Signal conversion – Image storage – Lighting techniques – Image processing and analysis – Data reduction: Edge detection, Feature extraction and object recognition – Applications – Inspection, Identification, Visual serving and navigation.

IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	13

Forward kinematics, Inverse kinematics and differences – Forward kinematics and Reverse kinematics of manipulators with Two and Three degrees of freedom – Deviations. – Robot dynamics – Static analysis - Robot programming – Teach pendant programming – Lead through programming – Robot programming languages – VAL Programming – Motion commands, Sensor commands, End effecter commands and Simple programs.

V	ROBOT APPLICATIONS IN MANUFACTURING	13

Robot applications – Material handling – Press loading and unloading – Die casting – Machine tool loading and unloading – Spot welding – Arc welding – Spray painting – Assembling – Finishing – Automatic Guided Vehicle – Adopting robots to workstations – Requisite robot characteristics and Non requisite robot characteristics – Stages in selecting robots for industrial applications – Safety considerations for robot operations – Robotics in the future and characteristics task– Economical analysis of robots – Social implications.

Text Books:

1) Industrial Robotics – Technology, Programming and Applications, .P.Groover, MC Graw Hill, 2001

Reference Books:

1) Robotics Control, Sensing, Vision and Intelligence, Fu.K.S.Gonzalz.R.C., and Lee C.S.G, McGraw-Hill Book   Co., 1987
2) Robotics for Engineers,Yoram Koren, McGraw-Hill Book Co., 1992
3) Robotics and Image Processing, Janakiraman.P.A, Tata McGraw-Hill,1995