TEACHING PLAN: **EE 348 ROBOTICS AND FACTORY AUTOMATION** (Credits 4:0:0)

July 2012 to Nov 2012

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Department / School : EEE / School of Electrical Sciences

Unit No.	Lecture No.	Topic	Book & Page Nos. Used for teaching	Topic No.	Date Taught
Unit 1 Fundamental concepts of Robotics	1	Introduction	Syllabus	-	
	2-3	History, present status and Future trends in Robotics and automation	Pg.No. 5 – 12 Deb. S. R.	1.3	
			Pg.No. 15 – 17 Mikell P Groover	1.4	
	4	Laws of Robotics, Robot definitions	Pg.No. 12 – 14 Deb. S. R	1.4, 1.5	
	5-7	Robotics systems and robot anatomy	Pg.No. 14 – 45 Deb. S. R.	1.6	
	8	Specification of Robots	Pg.No. 52 – 54 Deb. S. R.	1.8	
			Pg.No. 97 – 99 Richard D Klafter	2.5	
	9	Resolution, repeatability and accuracy of a manipulator	Pg.No. 181 – 189 Richard D Klafter	3.8	
	10-11	Robotics applications	Pg.No. 57 – 79 Richard D Klafter	1.9	
Unit 2 Robot Drives and Power transmission systems	12	Robot drive mechanisms – Hydraulic	Pg.No. 75, 89 – 108 Deb. S. R.	3.1, 3.3.3	
	13-14	Electric	Pg.No. 120 – 128 Deb. S. R.	3.5, 3.5.1	
	14-15	Servomotor & Stepper motor	Pg.No. 141 – 146 Deb. S. R.	3.7	
	16	Pneumatic drives	Pg.No. 108 – 120 Deb. S. R.	3.4	
	17-19	Mechanical transmission method – Gear transmission, belt drives, Cables, Roller chains, Link – Rod systems	Notes		
	20-21	Rotary –to-Rotary motion conversion, Rotary-to-Linear conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws	Notes		

	22-23	End effectors – Types	Pg.No. 151 – 170 Deb. S. R.	4.1 – 4.10	
Unit 3 Sensors	24	Sensor Characteristics	Notes		
	25	Position Sensors – Potentiometers, Encoders	Pg.No. 324 - 340 & Pg.No. 335 - 339 Richard D Klafter	5.2.1, 5.3.2	
	26	Resolvers, LVDT	Pg.No. 316 – 320 & Pg.No. 342 - 355 Richard D Klafter	5.2.3, 5.2.6	
	27	Velocity sensors – Tacho generators, Encoders, Proximity sensors, Limit switches	Pg.No. 360 – 363 & Pg.No. 364 - 366 Pg.No. 369 – 370 Richard D Klafter	5.6, 5.6.1, 5.6.2,5.8, 5.8.1	
	28	Tactile sensors, Touch sensors, Force and Torque sensors	Pg.No. 384 - 402 Pg.No. 415 – 421 Richard D Klafter	5.9.1, 5.10, 5.10.1, 5.10.2	
	29-30	Robot Vision systems – Image capture, Camera – VIDICON & Solid state	Pg.No. 160 – 167 Mikell P Groover	7.1, 7.2	
	31	Image representation	Pg.No. 453 – 462 Richard D Klafter	6.3, 6.4, 6.5.1	
	32	Image sampling and Quantization	Pg.No. 168 – 171 Mikell P Groover	7.2	
	33-34	Image processing and analysis - Image data reduction, Segmentation, Feature extraction, Object Recognition	Pg. No. 172 – 181 Mikell P Groover	7.3	
	35-36	Image capturing and communication – JPEG, MPEGs and H.26x standards, packet video, error concealment – Image texture analysis	Notes		
Unit 4 Transformations and Kinematics	37-38	Homogeneous coordinates	Pg.No. 566 – 581 Richard D Klafter	8.2	
	39-40	Coordinate reference frames	Pg.No. 581 – 589 Richard D Klafter	8.3	
	41-42	Homogeneous transformations for the manipulator	Pg.No. 594 – 609 Richard D Klafter	8.5	
	43-44	The forward and inverse problem of manipulator kinematics –	Pg.No. 609 – 639 Richard D Klafter	8.6, 8.7	
	45-46	Motion generation, Manipulator dynamics	Pg.No. 640 – 649 Richard D Klafter	8.8	
	47	Jacobian in terms of D-H matrices	Pg.No. 649 – 657 Richard D Klafter	8.9	

	48	Controller architecture.	Pg.No. 657 – 661 Richard D Klafter	8.10	
Unit 5 PLC & Factory Automation	49	Building blocks of automation	Pg. No. 379 – 390 Frank.D.Petruzella	14.2, 14.3	
	50	Controllers – PLC, Role of PLC in FA, Architecture of PLC, Advantages	Pg.No. 4 – 12 Frank.D.Petruzella	1.1, 1.2, 1.3	
	51	Types of PLC, Types of Programming	Notes		
	52	Simple process control programs using Relay Ladder Logic and Boolean logic methods	Notes		
	53	PLC arithmetic functions	Pg.No. 300 – 310 Frank.D.Petruzella	11.1 – 11.5	
	54	Factory Automation: Flexible Manufacturing Systems concept	Notes		
	55	Automatic feeding lines, ASRS, Transfer lines	Notes		
	56	Automatic inspection	Notes		
	57	Computer Integrated Manufacture, CNC	Pg.No. 409 – 419 Frank.D.Petruzella	15.2 – 15.4	
	58	Intelligent automation,	Notes		
	59	Industrial networking, bus standards	Notes		
	60	HMI Systems, DCS and SCADA, Wireless controls	Notes		

References

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, “Robotics Engineering – An Integrated Approach”, Eastern Economy Edition, Prentice Hall of India Private Limited., New Delhi, 1989.
2. Fu K.S., Gomalez R.C., Lee C.S.G., “Robotics: Control, Sensing, Vision and Intelligence”, Mc Graw- Hill Publishing Company Limited, New York, 1987.
3. Mikell P Groover et. Al., “Industrial Robots – Technology, Programming and Applications”, McGraw Hill Publishing Company Limited, New York, 1986.
4. Saeed B Niku, “Introduction to Robotics Analysis, Systems, Application”, Prentice Hall of India Private Limited, New Delhi, 2003.
5. Deh S R., “Robotics Technology and Flexible Automation”, Tata McGraw –Hill Publishing Company Limited, New Delhi, 1994.
6. Frank D. Petruzella, “Programmable Logic Controller”, 2nd Edition, Glencoe McGraw-Hill, New York, 1998.