Annexure E 4

SHRI VISHWAKARMA SKILL UNIVERSITY

(A STATE GOVT SKILL UNIVERSITY ESTABLESHED BY GOVT.OF HARYANA)

Name of the Skill Faculty: Skill Faculty of Engineering & Technology

Name of the Programme/Course: B. Voc. (Robotics and Automation) with JBM Group

Duration of the course: 6 Semesters/3 Years

Batch: **2020-2023 onwards**

Scheme of B.Voc (Robotics and Automation) Batch: 2020-2023 onwards

Semester-I															
Category	Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO		T	P	TO
General Education Component	ENG-501 ENG-501L	Communication Skills	3	1	4	15	35	50	35	15	50	100	45	30	75
	EE-501 EE-501L	Basics of Electrical & Electronics Engineering	3	1	4	15	35	50	35	15	50	100	45	30	75
	MTH-501	Applied Mathematics	4	0	4	30	70	100	-	-	-	100	60	-	60
	CSE-501 CSE-501L	Fundamental of Computers	3	1	4	15	35	50	35	15	50	100	45	30	75
	IMS-501 IMS-501L	Fundamental of Industrial Management and Safety	3	1	4	15	35	50	35	15	50	100	45	30	75
	Total		16	4	20	90	210	300	140	60	200	500	240	120	360
Skill Education Component	ME-504L	Workshop Practice	0	4	4	-	-	-	70	30	100	100	0	120	120
	RA-501 RA-501L	Fundamental of Robotic System	3	1	4	15	35	50	35	15	50	100	45	30	75
	ME-501L	Engineering Graphics and Drawing	0	4	4	-	-	-	70	30	100	100	-	120	120
	Total		3	9	12	15	35	50	175	75	250	300	45	270	315
Grand Total			19	13	32	105	245	350	315	135	450	800	285	390	675

Scheme of B.Voc (Robotics and Automation) Batch: 2020-2023 onwards

Semester-II															
Category	Subject Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO		T	P	TO
General Education Component	OET-502	*MOOC/Online Course-I (Industrial Automation & Control)	2	0	2	30	70	100	0	0	0	100	30	0	30
	OMS-501	Entrepreneurship (MOOC/Online Course-II)	2	0	2	30	70	100	0	0	0	100	30	0	30
	Total		4	0	4	60	140	200	0	0	0	200	60	0	60
Skill Education Component	OJT-501	On Job Training (OJT)	0	24	24	-	-	0	245	105	350	350	0	1080	1080
	Total		0	24	24	0	0	0	245	105	350	350	0	1080	1080
Grand Total			4	24	28	60	140	200	245	105	350	550	60	1080	1140

Note: * Relevant MOOC/Online course will be offered as per the availability.

Job Role: Level-5

Industrial Automation Specialist (QP IAS/Q8005)

Scheme of B.Voc (Robotics and Automation) Batch: 2020-2023 onwards

Semester-III															
Category	Subject Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO		T	P	TO
General Education Component	ME-604 ME-604L	Kinematics and Dynamics of Robots	3	1	4	15	35	50	35	15	50	100	45	30	75
	ECE-603 ECE-603L	Microprocessor and Microcontroller	3	1	4	15	35	50	35	15	50	100	45	30	75
	ECE-602 ECE-602L	Electronic Devices and Circuits	3	1	4	15	35	50	35	15	50	100	45	30	75
	EE-601 EE-601L	Automatic Control System	3	1	4	15	35	50	35	15	50	100	45	30	75
	ECE-605 ECE-605L	Sensors Applications in Manufacturing	3	1	4	15	35	50	35	15	50	100	45	30	75
	Total		15	5	20	75	175	250	175	75	250	500	225	150	375
Skill Education Component	RA-601 RA-601L	Industrial Automation System	3	1	4	15	35	50	35	15	50	100	45	30	75
	ME-605 ME-605L	Hydraulics and Pneumatics	3	1	4	15	35	50	35	15	50	100	45	30	75
	RA-602 RA-602L	Industrial Robotics & Material Handling System	3	1	4	15	35	50	35	15	50	100	45	30	75
	Total		9	3	12	45	105	150	105	45	150	300	135	90	225
Grand Total			24	8	32	120	280	400	280	120	400	800	460	240	600

Scheme of B.Voc (Robotics and Automation) Batch: 2020-2023 onwards

Semester-IV															
Category	Subject Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO		T	P	TO
General Education Component	OET-602	*MOOC/Online Course-III (Introduction to Embedded System Design)	2	0	2	30	70	100	0	0	0	100	30	0	30
	OAE-101	Human Values and Professional Ethics (MOOC/Online Course-IV)	2	0	2	30	70	100	0	0	0	100	30	0	30
	Total		4	0	4	60	140	200	0	0	0	200	60	0	60
Skill Education Component	OJT-601	On Job Training (OJT)	0	24	24	-	-	0	245	105	350	350	0	1080	1080
	Total		0	24	24	0	0	0	245	105	350	350	0	1080	1080
Grand Total			4	24	28	60	140	200	245	105	350	550	60	1080	1140

Note: * Relevant MOOC/Online course will be offered as per the availability.

Job Roles: Level-6

Robotics and Automation Associate

Scheme of B.Voc (Robotics and Automation) Batch: 2020-2023 onwards

Semester-V															
Category	Subject Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO		T	P	TO
General EducationComponent	OET-701 OET-702	*MOOC/Online Course-V (Fundamentals of Artificial Intelligence) **OR** *MOOC/Online Course-V (Cyber Security Tools Techniques and Counter Measures)	2	0	2	30	70	100	0	0	0	100	30	0	30
	OAE-103	Consumer Affairs (MOOC/Online Course-VI)	2	0	2	30	70	100	0	0	0	100	30	0	30
	Total		4	0	4	60	140	200	0	0	0	200	60	0	60
Skill Education Component	OJT-701	On Job Training (OJT)	0	24	24	-	-	0	245	105	350	350	0	1080	1080
	Total		0	24	24	0	0	0	245	105	350	350	0	1080	1080
Grand Total			4	24	28	60	140	200	245	105	350	550	60	1080	1140

Note: * Relevant MOOC/Online course will be offered as per the availability.

Scheme of B.Voc (Robotics and Automation) Batch: 2020-2023 onwards

Semester-VI															
Category	Subject Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO		T	P	TO
General Education Component	ECE-701 ECE-701L	Linear Integrated Circuits	3	1	4	15	35	50	35	15	50	100	45	30	75
	RA-701 RA-701L	Mobile Robots	3	1	4	15	35	50	35	15	50	100	45	30	75
	ME-701	Micro Electro Mechanical System	4	0	4	30	70	100	-	-	-	100	60	-	60
	IMS-704	Leadership and Quality Management	4	0	4	15	35	50	35	15	50	100	45	30	75
	EE-701L	Special Machines and Controllers Lab	0	4	4	-	-	-	70	30	100	100	0	120	120
	Total		14	6	20	75	175	250	175	75	250	500	195	210	405
Skill Education Component	ETP-701L	Project	0	4	4	-	-	-	70	30	100	100	0	120	120
	RA-703 RA-703L	Robotic Design and Control	3	1	4	15	35	50	35	15	50	100	45	30	75
	EE-702 EE-702L	Power Electronics & Drives	3	1	4	15	35	50	35	15	50	100	45	30	75
	Total		6	6	12	30	70	100	140	60	200	300	90	180	270
Grand Total			20	12	32	105	245	350	315	135	450	800	285	390	675

Job Roles: Level-7

Robotics and Automation Junior Executive

Syllabus

(1st Year-First and Second Semester)

for

B.Voc. (Robotics and Automation)

Industry Partner: JBM Group

Batch: (2020-2023) onwards

Communication Skills

Subject Code: ENG-501

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To inculcate in students professional and ethical attitude, effective communication skills, teamwork, skills, multidisciplinary approach and an ability to understand engineer's social responsibilities.
- To inculcate in students written communication skills.

Learning Outcomes:

The syllabus introduces students to have basic skill set of channelizing information, self-development, decision making and interpersonal skills.

Unit-1

Communication: Meaning of Communication, Importance of Communication, Types of communication. Process of communication, Communication network in an organization, Barriers to communication, Essentials of good communication.

Unit-II

Remedial English Grammar: Articles, agreement between subject and verb, uses of tenses, Modal and their uses, Prepositions.

(a) Understanding and applying Vocabulary: One-word substitutes, Synonyms and Antonyms

(b) Word formation:- Prefixes, Bases and Suffixes.

Unit-III

Listening Skills: The process of listening, Types of listening, Benefits of effective listening, Barriers to listening, listening to announcements at work place.

Unit-IV

Reading Skills: Process and methodologies of reading, Skimming and scanning, Levels of reading, Proofreading, Summarizing, Precise writing, Unseen comprehension passage, Note taking and reviewing, convert the given information into charts and graphs.

Unit-V

Writing Skills: Main Forms of Written Communication: Notices, Drafting an E-mail. Correspondence: Personal and Official, Notices, Technical Report Writing, Preparing agenda and minutes of meetings

Text Books

1. Sethi, J & et al. A Practice Course in English Pronunciation, Prentice Hall of
2. India, New Delhi.
3. Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.
4. Prasad, P. Communication Skills, S.K. Kataria & Sons.
5. Bansal, R.K. and J.B. Harrison. Spoken English, Orient Language.
6. Roach Peter. English Phonetics and Phonology.

Communication Skills Lab

Subject Code: ENG-501L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. Greeting and starting of conversation.
2. Nonverbal communication techniques during conversation.
3. Verbal communication techniques during conversation.
4. Group discussion.
5. Extempore public speaking.
6. Reading activity
7. Situational dialogues /Role play.
8. PPT presentation technique.

Basics of Electrical & Electronics Engineering

Subject Code: EE-501

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To Provide knowledge of Electrical Circuits.
- To Provide knowledge of Electrical Protective Equipment's.
- To Provide knowledge of Semiconductor and Applications.

Learning Outcomes:

- Able to understand the concept of Current, Voltage and Power.
- Able to understand the concept of Transformers and Motor.
- Able to understand the concept of Relay and Circuit Breaker.
- Able to understand the concept of Semiconductor diodes & Bipolar Junction Transistor.

Unit-I

D.C Circuits: Definition of Voltage, Current, Power, Resistance, Inductance and Capacitance with their units, Ohm's law, Kirchhoff's Law, Series -Parallel Circuit, Conversion of Current and Voltage Source.

Unit-II

Three Phase A.C Circuits: Generation of 3 phase E.M.F, Difference between three-phase and single-phase supply, Star connection, Delta Connection and its Conversion.

Unit-III

Electrical Machines: Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Transformer, Induction Motor, Servo & Stepper motors.

Unit-IV

Protective Devices & Safety Precautions: Introduction to PPE (Personal Protective Equipment) & Safety Precautions, Introduction of Relays, Contactors, MCBs, ELCBs, Fuses, Concept of Neutral and Earthing.

Unit-V

Semiconductor Devices & its Applications: Basic idea of semiconductors – P and N type; diodes, Zener diodes and their applications, transistor – PNP and NPN, symbols, identification of terminals of transistor, current flowing in a transistor, its characteristics and uses. Characteristics and applications of a thyristor.

Text Books

- Basic of Electrical and Electronics Engineering by S.k Sahdev, Dhanpatrai Publications,2013.
- Text Book of Electrical Technology by B.L Theraja, S.Chand Publications,2014

Reference Books

- A Course in Electrical Technology by J.B Gupta, Katson Publications,2013
- Electrical Technology by J.S Katre, Techmax Publications, 2016

Basics of Electrical & Electronics Engineering Lab

Subject Code: EE-501L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments

1. Introduction of tools, symbols and abbreviations.
2. To verify Kirchhoff's current & voltage law.
3. Construction & Working of DOL starter.
4. Construction & Working of Star-Delta starter.
5. Construction & Working of Distribution Board and Extension Board.
6. To perform open circuit test and short circuit test of a single-phase transformer.
7. Draw V-I characteristics of P-N junction diode.
8. Draw input and output characters of a transistor.
9. Draw reverse break down characteristics of a Zener diode.
10. Construction & Working of Half Wave & Full Wave rectifier on bread board.

Applied Mathematics

Subject Code: MTH-501

Credit	Hours	Marks		
04	60	I	E	To
		30	70	100

Objectives:

1. Acquire knowledge in matrix theory, a part of linear algebra, which has wider application in engineering problems.
2. To make the student knowledgeable in the area of Permutation and combination, trigonometric functions and to solve engineering problems based on the above concepts.
3. To make the student knowledgeable with basic and applied mathematics for further application.

Learning Outcome:

1. The graduates will become familiar with fundamentals of various Mathematical concepts.
2. Students will be able to set up and solve linear systems/linear inequalities graphically/geometrically and algebraically
3. Students will be able to formulate problems in the language of sets and perform set operations, and will be able apply the Fundamental Principle of Counting, Multiplication Principle.
4. Solve equations and inequalities, both algebraically and graphically, and Solving and model applied problems.

Skill Set

1. Acquire more knowledge in basic concepts of engineering mathematics.
2. To improve problem evaluation technique.
3. Choose an appropriate method to solve a practical problem.

Content

1. **Algebra:**
   - **1.1.** Set theory
   - **1.2.** Permutation and Combination
   - **1.3.** Binomial theorem (expansion without proof)
   - **1.4.** Types of functions – linear, quadratic, polynomial, exponential and logarithmic

2. **Trigonometric functions**:
   - **2.1.** Review of ratio of some standard angles (0, 30, 45, 60, 90 degrees)

2.2. Addition, subtraction and product formulae

2.3. Multiple and submultiples angles (2A, 3A, A/2)

2.4. Height and distance

3. **Determinants and matrix:**

3.1. Introduction to Determinant and matrices

3.2. Algebra of matrices (up to third order)

3.3. Inverse of matrix by Adjoint method (up to second order)

3.4. Solution of system of linear equations by Cramer's rule

4. **Differential calculus:**

4.1. Rules of differentiation – simple standard forms (involving one variable)

4.2. Derivatives of algebraic and trigonometric functions

4.3. Differentiation of function of a function

4.4. Chain rule

5. **Integral calculus:**

5.1. Integral of standard forms

5.2. Simple integration by substitution

5.3. Integration by parts and by fractions (for linear factor only)

5.4. Evaluation of definite integrals

Suggested Readings:

1. NCERT- 11^{th} and 12^{th} Mathematics.

2. Advanced Engineering Mathematics, E. Kresyzig, John Wiley and Sons. (latest edition).

3. Higher Engineering Mathematics, B.S. Grewal, Khanna Publications

4. Advanced Engineering Mathematics, R.A Jain and S.R.K Iyengar. Narosa Publications.

5. Engineering Mathematics, N.P Bali, Laxmi Publications.

Fundamental of Computers

Subject Code: CSE-501

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objective:

The syllabus introduces students to basic information and communication technology and proper paradigms that need to be implemented to develop any kind of computer applications. The course will help in developing the basic technical skills by hands on experience.

Learning Outcome:

- Students will be able to the use the computer for basic purposes of preparing personnel/business letters, viewing information on Internet, sending mails, using internet banking services etc.
- Understand basic computer operations and ICT applications.
- Understand Network troubleshooting.
- Undertake data entry services

Unit I – Introduction to Computer System:

What is Computer, Basic Applications of Computer; Block Diagram of Computer System, Input / Output Devices, Computer Memory, Concepts of Hardware and Software, Data and Information; Applications of IECT, Computer Virus: Definition, Types of viruses, Characteristics of viruses, Anti-virus software, Introduction to number system.

Unit II - Operating System: Overview of operating system: Definition, Functions of operating system, Need and its services, Types of operating system, Batch Processing, Spooling, Multiprocessing, Multiprogramming, Time-Sharing, On-Line Processing, Real-Time Processing Basics of window operating system, Comparison between DOS and windows, Switching between DOS and windows, Comparison between Unix and Windows.

Unit III - Understanding Office Applications: Introduction to MS Word, Introduction to MS Excel and its applications, Introduction to MS PowerPoint, Menus, Shortcuts, Document types, Formatting documents, spread sheet and presentations, Working with Spreadsheets, Different templates, Macros, Mail merge.

Unit IV- Networking: Network Technologies, Introduction to Internet and protocols: TCP/ IP, Network connecting devices, Topologies, HTTP, HTTPS DNS, Hub, Switches, Router, Repeater, Firewalls, Digital Signature.

Unit V: Introduction to World Wide Web: WWW and Web Browsers Introduction, Objectives, Concept of internet, Overview of search engines, popular search engines in use, Surfing the web and websites, Hosting your websites, Planning and Developing the websites, Internet service provider.

Text Books:

1. Computers and Beginners by Jain, V.K.;
2. Computer Fundamentals by Anita Goel, Pearson.

Reference Books:

1. Introduction to Information Technology, Leon Tech World by Leon and Leon
2. Foundations of Computing, BPB Publiction by Sinha, Kr. Pradeep and Preeti Sinha;
3. Word Processing and Typing by Sharon Spencer, Heinemann.
4. MS Office by S.S. Srivastava, Firewall Media.
5. Microsoft Office 2010 by Bittu Kumar, V & S Publications
6. Data Communication and Networking by Behrouz.A. Forouzan, McGraw Hill

Web Links http://cec.nic.in/E-Content/Pages/default.aspx

Fundamental of Computers Lab

Subject Code: CSE-501L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. Troubleshooting
2. Practical based on to be exposed/shown various components and supposed how to switch on a computer.
3. Handling Boot Setup, Installation of Operating System, Connecting your client to server, User and Workgroup Handling, General Operating system handling and related topics.
4. WordPad, Notepad, Sticky Note, Snipping tool, Paint
5. M.S. Word
6. MS-Excel- Creating charts, Creating tables

7. MS-PowerPoint
8. MS-Outlook
9. Case study on Operating systems (Windows/ Ubantu/ Android/IoS)
10. Networking
11. Software: Preparatory and open domain

Note: Any 7 experiments are to be performed

Fundamental of Industrial Management and Safety

Subject Code: IMS-501

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

1) Understanding the knowledge of Quality Control, inspection and quality assurance management used in the organization.
2) Develop the skill for using tool and techniques for quality in Industry
3) Apply elementary knowledge of quality concepts for quality assurance.

Unit-I

Concept of Quality:

1.1 Quality: Definition, History, Importance
1.2 Approaches to define Quality, Cost of Quality, Hierarchy of Quality Management
1.3 Introduction to Quality Control.

Learning Outcome: Students will be able to understand the daily management system related to Quality in the shop floor.

Unit-II

Organizational Aspects of Quality Assurance:

Quality Assurance (QA): Introduction, Definition, Management principles in QA, QA in different stages, Quality Planning, ISO: Introduction, ISO 9000 series of standard, Benefits of ISO. ISO 9001, Benefits of ISO 9001, Quality survey: Scope, Types of audit, inspection methods, Quality budget, Vendor Quality Rating

Learning Outcome: Students will be able to understand all the required processes, ensuring implementation of the same and providing basic inputs for its improvement. Student will be able to ensure that the final products manufactured by is as per the quality norms set by the organization.

Unit-III

Problem solving tools and techniques:

Definition of a problem, Type of problems, classification of problems, What is problem solving, barriers to problem solving, Problem solving tools: Cause and effect diagram, Histogram, flow charts, Check sheets, Histogram, Brain-storming, Pareto charts, Control charts, Scatter Diagram, Problem solving techniques: Brain storming, Flow diagram, PDCA Cycle etc.

Learning Outcome: Student will able to solve different type of problems in their manufacturing processes.

Unit-IV

Total Quality Management:

Basic concept of TQM, features of TQM, principles of TQM, leadership concepts, Quality statements, Barriers to TQM implementation, Concept of TPM, Quality allied concept: KAIZEN, Poke yoke, JIT, KAPA

Learning Outcome: Ensure implementation of 5S activities at the shop floor/ office area. Students will be able to analyse the root cause problems in the product & process by using different problem-solving techniques.

Unit-V

5 S and Safety: Detailed concept of 5S and safety used in Industries, Integrated Management system

Learning Outcome: Students will able to apply 5S and safety in their work place.

Suggested Readings:

1. Total quality Management by L.Sganthi & Anand A. Samuel, PHI Publication.
2. Total quality Management by Poornima M Charantimath, Pearson Publication.

Web Reference

www.slideshare.net/MALLURSB/unit-1-quality-total-quality-tqm
http://smallbusiness.chron.com/quality-important-business-57470.htm
https://totalqualitymanagement.wordpress.com/2008/09/12/cost-of-quality
https://accountlearning.com/approaches-to-total-quality-management/
https://prezi.com/a8qypxkz5uee/hierarchy-of-quality-management
www.asiainspection.com/quality-control-services/product-and-manufacturing-inspections
http://whatis.techtarget.com/definition/quality-control-QC
http://searchsoftwarequality.techtarget.com/definition/quality-assurance
www.slideshare.net/Genesys.../the-8-principles-of-quality-assurance-trainin
http://electronicstechnician.tpub.com/14085/css/Qa-Forms-And-Records-113.htm

Fundamental of Industrial Management and Safety Lab

Subject Code: IMS-501L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments

1. Draw and Demonstrate the process flow diagram
2. Draw and demonstrate problem statement, target /Goal Setting
3. Draw and demonstrate Pareto diagram
4. Draw and Demonstrate cause and effect diagram
5. Data validation and why –why Analysis

All these techniques applied can be used as a project to solve the problems in their workplace in OJT.

Workshop Practice

Subject Code: ME-504L

Credit	Hours	Marks		
04	120	I	E	To
		70	30	100

Objectives:

- Acquire knowledge and use simple hand tools
- Acquire knowledge and use simple measuring and gauging instruments.

Learning Outcomes:

- Able to understand metrology aspects.
- Able to know various welding processes, defects associated & remedies.

List of Experiments

1. To turn a 30mm cylindrical rod of 105mm length in to 20mm dia over span of 100mm.
2. To turn a bush of 32mm length of which 16mm length is of 30mm dia & rest 16mm is 26mm dia with 18mm bore at centre.
3. To perform step turning in to 3 step of 32mm, 26mm & 20mm over the length 100mm (As per given drawing)
4. To perform step milling operation with a step of 8×8mm in square block of 40×40×40mm.
5. To perform face milling operation on a rectangular block of 100×30×8mm to make parallel plate.
6. To make T- fitting as per given drawing sheet.
7. To make U- Channel by fitting operations as per given drawing.

Fundamental of Robotic System

Code: RA-501

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- To discuss about the various applications of robots, justification and implementation of robot

Learning Outcomes:

- Able to know about the basics of robotics system such as specification, driving system & parts.
- Able to have learning about the applications of Robots.

Unit-I

Introduction: Specifications of Robots (Manipulator & controller)- Classifications of robots – Work envelope - Flexible automation versus Robotic technology – Applications of Robots. Operators: Translations, Rotations and Transformation.

Unit-II

Robot Drives and Power Transmission Systems: Robot drive mechanisms, hydraulic – electric – servomotor- stepper motor - pneumatic drive. Mechanical transmission method - Gear transmission link - Rod systems - Rotary-to-Rotary motion conversion.
Applications - MIG & BIW welding lines, Handling system.

Unit-III

Manipulators: Construction of Manipulators, Manipulator Force Control, Electronic and Pneumatic manipulators

Unit-IV

Robot end Effectors: Classification of End effectors. Drive system for Grippers-Mechanical-adhesive-vacuum-magnetic-grippers. Hooks & scoops. Active and passive grippers.
Application: Robotic Gun, welding torch, Gripper, Automatic Tool changer.

Unit-V

Pathplanning Tools: Trajectory planning and avoidance of obstacles, path planning, joint integrated motion – straight line motion.

Text Books:

1. Deb S. R. and Deb S., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010.
2. John J.Craig , “Introduction to Robotics”, Pearson, 2009.

Reference Books:

1. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.

Fundamental of Robotic System Lab

Subject Code: RA-501L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
6. Estimation of accuracy, repeatability and resolution.
7. Robot programming exercises

Engineering Graphics & Drawing

Code: ME-501L

Credit	Hours	Marks		
04	120	I	E	To
		70	30	100

Objectives

1. Understand and appreciate the importance of Engineering Graphics in Engineering
2. Understand the basic principles of Technical/Engineering Drawing
3. Understand the different steps in producing drawings according to BIS conventions

Outcomes

1. The student will become familiar with fundamentals of various science and technology subjects and thus acquire the capability to applying them
2. The graduates will become familiar with fundamentals of engineering design. Understanding the concept generation, design optimization and evaluation.
3. Students will be able to effectively design various engineering components and make process plan for the production.

Skill Set

1. Projection of various components according to BIS specifications.
2. Assembly of data and information of various components in visualized way
3. Interpretation of technical graphics assemblies

Contents

Introduction to drawing, lines and lettering:

1.1. Definition and classification of drawing

1.2. Drawing instruments such as; drawing board, drawing sheets, drafter.

1.3. Types of pencils, sheets, eraseretc.

1.4. Different types of lines(Straight line, inclined line and curved lines)

1.5. Practice engineering style for letters and numbers as BIS: SP:46-2003

Hands on training:

- Prepare drawing sheet by using different types of lines Prepare drawing sheet by Bisection of line, angle, arc.

2. Dimensioning and scale:

2.1. Importance of dimensioning

2.2. Types (i.e. chain, parallel and progressive etc.) and methods of placing dimensioning (i.e. aligned and unidirectional)

2.3. Principles of dimensioning and practice dimensioning technique as BIS: SP: 46-2003.

2.4. Free hand sketching of straight lines, circle, square, Polygons

Hands on training:

- To divide line of length 120mm into 9equal parts
- Divide a circle into 12 equal parts by using engineering compass

3. Introduction to Projection:

3.1. Introduction to first and third angle projection

3.2. Introduction to projection of point, line and plane

3.3. Sectioning of solids

Hands on training:

- Practice for projection of point
- Practice for projection of line
- Practice for projection plane

4. Isometric and Orthographic projection

1.1 Isometric drawing of simple geometric solids 1.2 Orthographic projection of simple geometric solids.

Hands on training:

- Prepare drawing sheet of orthographic projection
- Prepare drawing sheet of isometric projection.

5. Geometric and dimensioning Tolerance

5.1 Component Drawing and interpretation

5.2 Geometric dimension and Tolerance

5.3 Introduction to software used in drawing

Text Book:

1. Engineering Drawing Plane and Solid Geometry : N.D. Bhatt and V.M. Panchal, Forty-Fourth Edition 2002, Charotar Publishing House.
2. Engineering Drawing: Laxmi Narayan and Vaishwanar, Charotar Publishing House.
3. Engineering Graphics and Drafting: P.S. Gill, Millennium Edition, S.K. Kataria and Sons.
4. Engineering Graphics using AUTOCAD 2007: T. Jeyapoovan, m First Edition 2002, Vikas Publishing House.

*MOOC/Online Course-I (Industrial Automation and Control)

Subject Code: OET-502

Credit	Hours	Marks		
02	30	I	E	To
		30	70	100

Course Objectives:

This course provides an overall exposure to the technology of Industrial Automation and Control as widely seen in factories of all types both for discrete and continuous manufacturing. The course will focus on a wide range of related topics from the advantage and architecture of automation systems, measurement systems including sensors and signal conditioning, discrete and continuous variable control systems, hydraulic, pneumatic and electric actuators, industrial communication and embedded computing and CNC Machines.

Learning Outcomes

Students will able to

- Describe the major role of automation in the industry.
- Define the performance objective of automatic control.
- Define the parameter to PID Controller.
- Describe the principle of operation of hydraulic and pneumatic systems and understand its advantages.
- Describe the concept of sequencing controlling.
- Describe the functionality of DC motor and Switching operations.

Unit	Topic	Key Learning
I	Introduction	Introduction to industrial automation, Role of automation system in industry, Type of Automation System, Architecture of industrial automation system
II	Automatic control system	Introduction to automatic control system, PID controller: Definition, Parameters of PID Controller
III	Sequencing Control	Introduction to sequencing control, Parameters of PLC, Scan Cycle, Relay Logics
IV	Hydraulic and Pneumatics Control System	Pascal Law, Components of Hydraulic and pneumatic system, Direction control valve, Advantages of Hydraulic and Pneumatic system
V	DC motor	Main Features of the DC Motor, Block diagram of DC motor control loops, Switch mode DC-DC converter for DC Motor control, BLDC Motor

Text Books:

1. Industrial Instrumentation, Control and Automation, S. Mukhopadhyay, S. Sen and A. K. Deb, Jaico Publishing House, 2013
2. Chemical Process Control, An Introduction to Theory and Practice, George Stephanopoulos, Prentice Hall India, 2012

Reference Books:

1. Electric Motor Drives, Modelling, Analysis and Control, R. Krishnan, Prentice Hall India, 2002
2. Hydraulic Control Systems, Herbert E. Merritt, Wiley, 1991

Entrepreneurship (MOOC/Online Course-II)

Subject Code: OMS-501

Credit	Hours	Marks		
02	30	I	E	To
		30	70	100

Objectives:

- Enable the students to develop the insight needed to discover and create entrepreneurial opportunities.
- Successfully start and manage their own businesses to take the advantage of these opportunities.

Learning Outcomes:

- The course will create awareness among the students about the entrepreneurship and factors that will help in facilitating the entrepreneurial development with a focus on new ventures/ start-ups.

Units	Topics	Learning outcomes
Unit-1	Introduction to Entrepreneurship	Introduction to Entrepreneurship, Entrepreneurial Mindset, Characteristic of an Entrepreneur, Advantages and disadvantages of Entrepreneurship
	Recognise Opportunity	Purpose of all businesses, Types of Entrepreneurial organizations, Types of Enterprises
	Creativity & Innovation	Marketing, 4Ps of Marketing, Process of Marketing, Marketing Mix, 7Ps of Marketing
	Conception & Ideation	Business Plan and its elements, Application of Business Plan
	Are you a risk taker?	Entrepreneurs, types of Entrepreneurs, Roles and Responsibilities of Entrepreneurs, Qualities of an Entrepreneur
	Identify Your Customer	Customer segmentation, Criteria for selling customer value proposition, Customer Lifecycle
Unit-2	Self Confidence and Resilience	4 Ps of Entrepreneurship, Qualities of successful entrepreneur, Self-confidence, Positive attitude, Overcoming the fears, Recover from Failure
	Success and Failure Stories of Famous Entrepreneurs – 1	Steve Jobs Success Story, Mumbai Dabbawala delivery success Story
	Never Give Up	Importance of Focusing energy on Business, Importance of Business Networking and its advantages
	Competition Analysis	Competition Analysis, Factors affecting competition strategies, Prerequisites of successful enterprise
	Risks – Identification and Mitigation	Business Risk, Types of Business Risks, Risk Identification, Risk Mitigation,
	Getting Money for Business	Concept Of Funding, Basics terms of Accounting, Types of Funding,

Unit-3	Dream and Achieve	Vision, Mission and Goals, Business Ethics, SMART goals, entrepreneurial work ethics
	Leadership and Team Spirit	Lead by example, Importance of Embracing diversity, Role of Emotional Intelligence to be a leader.
	Success and Failure Stories of Famous Entrepreneurs – 2	
	Serving the Society	Roles of Entrepreneurs in society, Selfless Entrepreneurship,
	Taking Ownership	Taking complete ownership, taking control over the business
	Adapt to Change	Porters competition strategies, Factors affecting business,
	Discover Yourself	Qualities of the successful entrepreneur
Unit-4	Problem Solving: Introduction to Critical Thinking	Critical Thinking, Applying critical thinking, REASON Model of Critical Thinking
	Problem Solving: Introduction to Creative Thinking	Creative thinking, Importance and benefits of Creative thinking, Creative thinking in problem solving
	Problem Solving: Introduction to Decision Making	Decision making, Effective decision-making process
Unit-5	4Ps of Marketing	4Ps- Product, Place, Price, Promotion, Apply 4Ps to marketing Strategy into action
	Costs in Entrepreneurship	Cost, types of Costs, Introduction to Accounting Basics, main methods of Accounting, Financial Documents, P&L statements, Working capital
	Applicable Sources of funding and Regulatory and Statutory rules	Regulatory and statutory rules for an Entrepreneur, Business Loans for startups and MSMEs by Indian Government
	Analysis of success and failure stories	Analysis of success and failure stories, Key skills involved in the successes of entrepreneurs
	Identification of one's entrepreneurial skills and knowledge	Identify various skills and characteristics o be an entrepreneur, Effective Ways to Build Entrepreneurial Skills, Develop or Improve your Entrepreneurial Skills.
	Legal Issues	Intellectual Property Rights, patents, trademarks, copyrights, trade secrets, licensing, franchising

Suggested Readings:

- Dollinger, MJ, Entrepreneurship- Strategies and Resources, Pearson Education.
- Desai,Vasant, Entrepreneurship Development, Himalaya Publishing House.
- Gupta, C.B. and Srinivasan, P., Entrepreneurship Development, Sultan Chand & Sons.
- Charanthimath, P.M., Entrepreneurship Development and Small Business Enterprise, Pearson Education.
- Havinal, Veerbhadrappa, Management and Entrepreneurship, 1st Edition, New Age International Publishers, 2008.

Syllabus

(2nd Year-Third and Fourth Semester)

for

B.Voc. (Robotics and Automation)

Industry Partner: JBM Group

Batch: (2020-2023) onwards

Kinematics & Dynamics of Robots

Subject Code: ME-604

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To understand the basic components and layout of linkages in the assembly of a system/ machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.

Learning Outcomes:

- Able to get fundamentals of mechanisms used in machines.

Unit-I

Introduction to kinematics

Introduction, Link, Pair, chain, mechanism, Degree of freedom, four bar mechanism, slider crank mechanism , inversion. Equivalent linkages

Unit-II

Kinematics of Rigid Body

Translation ,rotation, Velocity of point and link, linear and angular velocities, absolute and relative velocity in plane motion,acceleration of a point and link, relative acceleration, instantaneous centre, coriolis acceleration.

Unit-III

Dynamic force analysis

Forces and torques, mass and weight, mass moment of inertia, laws of motion, static forces, dynamic forces, dynamic forces in mechanisms

Unit-IV

Spatial linkages

Introduction to spatial mechanisms, robotic mechanisms.

Unit-V

Balancing: Need of balancing, Balancing of rotating masses, single plane, different planes, balancing and balancing machines.

Text Books:

- Ambekar A.G., “Mechanism and Machine Theory” Prentice Hall of India, New Delhi, 2007

- Shigley J.E., Pennock G.R and Uicker J.J., "Theory of Machines and Mechanisms", Oxford University Press, 2003.

Reference Books:

- Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
- Ghosh. A, and A.K. Mallick, "Theory and Machine", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
- Rao.J.S. and Dukkipatti R.V. "Mechanisms and Machines", Wiley-Eastern Ltd., New Delhi, 1992.

Kinematics & Dynamics of Robots Lab

Subject Code: ME-604L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. a) Study of gear parameters.
   b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.
   b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
   b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.
   c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination.
   b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies.
   b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.

Microprocessor & Microcontroller

Subject Code: ECE-603

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To study the Architecture of Microprocessor 8085 Microcontroller 8051
- To study the addressing modes & instruction set of 8085 & 8051.
- To introduce the need & use of Interrupt structure 8085 & 8051.
- To develop skill in simple applications development with programming 8085 & 8051
- To introduce commonly used peripheral / interfacing

Learning Outcomes:

- Able to understand and analyse, linear and digital electronic circuits.
- Able to understand and apply computing platform and software for engineering problems.

Unit-I

8085 Processor: Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts.

Unit-II

Programming Of 8085 Processor: Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing.

Unit-III

8051 Micro Controller: Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts-Comparison to Programming concepts with 8085.

Unit-IV

Peripheral Interfacing Study: Architecture, configuration and interfacing, with ICs: 8255 , 8259- A/D and D/A converters &Interfacing with 8085& 8051

Unit-V

Micro Controller Programming & Applications: Data Transfer, Manipulation, Control Algorithms& I/O instructions – Simple programming exercises- key board and display interface.

Text Books:

- Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi , 2007.

- R.S. Gaonkar, „Microprocessor Architecture Programming and Application", with 8085, Wiley Eastern Ltd., New Delhi, 2013.
- Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

Reference Books:

- Muhammad Ali Mazidi& Janice GilliMazidi, R.D.Kinely „The 8051 Micro Controller and Embedded Systems", PHI Pearson Education, 5th Indian reprint, 2003.
- N.Senthil Kumar, M.Saravanan, S.Jeevananthan, „Microprocessors and Microcontrollers", Oxford,2013.
- Valder – Perez, "Microcontroller – Fundamentals and Applications with Pic," Yeesdee Publishers, Tayler& Francis, 2013.

Microprocessor & Microcontroller Lab

Subject Code: ECE-603L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. Write a program using 8085 for Hexadecimal addition & subtraction of two numbers.
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
3. Write a program to perform multiplication and division of two 8 bit numbers using 8085.
4. Write a program to control the operation of stepper motor using 8085/8086 and 8255 PPI.
5. Write a program to interface ADC & DAC with 8085 & demonstrate generation of square wave
6. Write a program to interface 8X8 LED Matrix Display using 8085/8086 microprocessors and 8255 PPI
7. Write a program to control the traffic light system using 8085/8086 and 8255 PPI
8. To study implementation & interfacing of Display devices Like LCD, LED Bar graph & seven segment display with Microcontroller 8051/AT89C51
9. Write a program to interface a graphical LCD with 89C51
10. Write an ALP for temperature & pressure measurement.

Electronic Devices & Circuits

Subject Code: ECE-602

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To know the structure, operation and applications of the basic electronic devices.

Learning Outcomes: Upon Completion of the course, the students will be able to

- Design circuits with transistor biasing.
- Design simple amplifier circuits.
- Analyze the small signal equivalent circuits of transistors.
- Design and analyze large signal amplifiers.
- Design power supplies and rectifiers

Unit-I

PN Junction Devices: PN junction diode –structure, operation and V-I characteristics, Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode-characteristics-Zener Reverse characteristics – Zener as regulator

Unit-II

Transistors: BJT, JFET, Biasing UJT, Thyristor and IGBT -Structure and characteristics.

UNIT-III

Amplifiers: BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model.

Unit-IV

Multistage Amplifiers And Differential Amplifier: BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response.

Unit-V

Feedback Amplifiers And Oscillators: Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge oscillators.

Text Books:

- David A. Bell ,"Electronic devices and circuits", Prentice Hall of India, 2004.
- Sedra and smith, "Microelectronic circuits " Oxford University Press, 2004.

Reference Books:

- Rashid, "Micro electronic circuits" Thomson publications, 1999.
- Floyd, "Electron devices" Pearson Asia 5th Edition, 2001.

Electronic Devices & Circuits Lab

Subject Code: ECE-602L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments (DBEC-202-P)

1. Characterisitics of diode and clipper circuits.
2. Characterisitics of Zener diode and Zener voltage regulator
3. Characteristics of BJT.
4. Characterisitics of JFET
5. Application of BJT as an amplifier and switch.
6. Study of Basic Digital ICs.
7. Implementation of Adder and Subtractor circuits
8. Design of Code converters.
9. Study of Multiplexer and Demultiplexer.
10. Design and Implementation of Counters and registers

Automatic Control System

Subject Code: EE-601

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To study the basics of control system and its response, stability of mechanical and electrical system.

Learning Outcomes:

- Able to expose students to the state space representation and its analysis.
- Able to introduce non-linear systems and their control. To impart knowledge on advanced control techniques

Unit-I

Introduction:

Open loop and closed loop systems - Examples - Elements of closed loop systems - Transfer function - Modelling of physical systems – Mechanical and Electrical, Transfer function of DC generator, Block diagram - reduction techniques, Signal flow graph – Mason‟ gain formula.

Modes- Speed mode & torque mode.

Unit-II

Time Domain Analysis:

Standard Test signals – Time response of second order system - Time domain specifications - Types of systems - Steady state error constants - Introduction to P, PI and PID modes of feedback control.

Uni-III

Frequency Domain Analysis:

Frequency domain specifications - Time and frequency response correlation – Polar plot – Bode plot – All pass minimum phase and non-minimum phase systems.

Unit-IV

Root Locus Method:

Root locus concepts - Construction of root loci – Root contours.

Unit-V

State Space Analysis:

Concepts of state, state variables and state model – state model for linear time invariant systems - Introduction to state space representation using physical - Phase and canonical variables.

Text Books:

- Nagrath I J, and Gopal, M, 'Control Systems Engineering" Prentice Hall of India, New Delhi, 2008.
- Hasan Saeed,"Automatic Control System" Katson Publication-2013
- Richard C Dorf and Robert H Bishop, "Modern Control Systems.", Addison-Wesley

Reference Books:

- Ogata K, "Modern Control Engineering", Pearson Education, New Delhi, 2006.
- Kuo B C, "Automatic Control Systems", Prentice-Hall of India Pvt. Ltd, New Delhi, 2004.
- Norman C. Nise S, "Control system Engineering", John Wiley & Sons, Singapore, 2004.

Automatic Control System Lab

Subject Code: EE-601L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. To study the speed control of D.C. Motor
2. To study the linear system simulator
3. To study the stepper motor and its interface with Microprocessor.
4. To study the D.C. Position control system
5. To study the Digital PID control system.
6. To study the PID and on-off control action on temperature control System.
7. To study the Relay control system.
8. To study Potentials Metrics Error Detector.
9. To study AC position control system.
10. To study Synchros.

Sensors Applications in Manufacturing

Subject Code: ECE-605

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objective:

- To introduce the terminologies associated with the sensing & measuring system.
- To impart knowledge on sensors and transducer for temperature measurements.
- To understand and calibrate the method of measuring pressure, displacement and velocity.
- To introduce flow measuring devices and operations
- To practically expose the students to different measurement devices and use of them to measuring different variable

Learning Outcomes:

- Able to explain the different terms related to measurement system
- Able to calibrate and use the sensors and transducer for temperature, force, pressure, velocity and displacements.
- Able to demonstrate different measurement techniques for measuring different variables.

Unit I

Fundamentals of Sensors and Transducers: Performance terminology, static and dynamic characteristics of transducers, classification of sensors and transducers, signal processing and signal conditioning. Operational amplifiers, filters, protection devices, analog to digital converter, digital to analog converter.

Unit II

Sensors and their applications: Inductive, capacitive, magnetic, various types of photo sensors, detection methods, through-beam detection, reflex detection & proximity detection, ultrasonic and microwave sensors. Applications and understanding of the above sensors. SLE: limit switches 8 Hrs

Unit III

Advanced Sensor Technologies: Laser production, characteristics of lasers, types of laser sensors, bar code sensors, benefits of bar coding, transponder, RFID (Radio Frequency Identification), electro-magnetic identifier, optical encoders ,.color sensors, sensing principles, color theory, unit color measurement, colour comparator, color sensing algorithm, fuzzy logic color sensor. fuzzy logic for opt-electronic colour sensor in manufacturing. SLE: Advantages and disadvantages of optical encoders 10 Hrs

Unit IV

Sensors in Flexible Manufacturing Systems: Vision sensors, image transformations, robot visual sensing tasks, detecting partially visible objects, sensors in flexible manufacturing system cell.

Unit V

Sensors for Special Applications: A multi objective approach for selection of sensors in manufacturing, cryogenic manufacturing applications, semiconductor absorption sensors, semiconductor temperature detector using photoluminescence temperature detectors using point-contact, sensors in process manufacturing plants, measurement of high temperature, robot control through sensors, other sensors, collection and generation of process signals in decentralized manufacturing system.

Text Books:

1. Sabnesoloman, sensors & control systems in manufacturing. Mc-Graw Hill book Company Network, 1994.
2. Mechatronics by W,Bolton,
3. Sensor Technology Handbook by Jon S. Wilson
4. N.L.Buck&T.G.Buckwith, Mechanical measurement.
5. Sensors and Transducers by Ian Sinclair

Reference Books:

1. Patranabis D, "Sensors and Transducers", Prentice-Hall of India Private Limited, New Delhi, 2003.
2. Ernest O Doebelin, "Measurement systems Application and Design", Tata McGraw-Hill Book Company, 2010

Sensors Applications in Manufacturing Lab

Subject Code: ECE-605L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. Measuring quantities using instruments
2. Measurement of temperature using Platinum RTD and plotting its characteristics
3. Measurement of temperature using NTC Thermistor and plotting its characteristics.
4. Study of strain measurement using strain gauges and cantilever assembly.
5. Flow measurement
6. Study of Input Output characteristics of LVDT.
7. To determine linear Range of operation and Sensitivity of LVDT.
8. Measurement of speed using a proximity switch
9. Velocity and displacement measurement using Encoder.
10. Tactile sensors for force and torque measurement

Industrial Automation System

Subject Code: RA-601

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To gain knowledge in various electrical and electronic programmable automations and their applications.

Learning Outcomes:

- knowledge of industrial automation
- Ability to apply PLC and usage of C programming for report generation
- Acquiring information's on communication protocols in automation systems
- Ability to design and develop automatic control system using distributed control systems.

Unit 1

Nature of Industrial Process: continuous & discrete state sequential process, process variables and their classification. Introduction to Process Control Philosophies: type of relays, ladder logic methodology, ladder symbols.

Unit 2

Introduction to Programmable Logic Controllers: advantages & disadvantages of PLC with respect to relay logic, PLC architecture, Input Output modules, PLC interfacing with plant, memory structure of PLC. PLC programming methodologies: ladder diagram, STL, functional block diagram, creating ladder diagram from process control descriptions, introduction to IEC61131 international standard for PLC.

Unit 3

PLC functions: bit logic instructions, ladder diagram examples, interlocking, latching, inter dependency and logical functions, PLC Timer & Counter functions on-delay timer, off-delay timers, retentive on-delay timers, pulse timers, timer examples, up-counter, down-counter and up-down counter, counter examples, register basics.

Unit 4

PLC Data Handling: data move instructions, table and register moves, PLC FIFO & LIFO functions.

PLC arithmetic and logical functions: addition, subtraction, multiplication, division instructions, increment decrement, trigonometric and log functions, AND, OR, XOR, NOT functions, PLC compare and convert functions.

Unit 5

PLC program control and interrupts: jumps, subroutine, sequence control relay, watchdog. Analog value processing: types of analog modules, analog input and output examples, PID control of continuous process.

Text/References:

• JOHN WEBB: Programmable Logic Controllers Principles & applications, PHI

• T. A. HUGHES: Programmable Controllers

• C. D. JOHNSON: Process Control Instrumentation

Industrial Automation System Lab

Subject Code: RA-601L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. Study of PLC architecture and connection details.
2. Introduction to bit logic instruction set
3. Study of PLC timers with ladder programming
4. Study of PLC counters with ladder programming
5. Introduction to PLC arithmetic and logical instructions
6. Study of PLC interrupts.
7. Introduction to PLC program control instructions
8. Communication of PLC with PC with Free Port Protocol.
9. Introduction to Analog value processing on PLC.
10. Mini project of course (mandatory)

Hydraulics & Pneumatics

Subject Code: ME-605

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution.

Learning Outcomes:

- Able to Identify hydraulic and pneumatics components.
- Able to design hydraulic and pneumatic circuits.

Unit-I

Introduction: Need and importance of hydraulic and pneumatic, Hydrostatic and hydrodynamic definitions, properties of fluid, Pascal's law, Continuity equation and Bernoulli's equation. Advantages and limitations of hydraulic and pneumatic systems.

Unit-II

Hydraulic Pump: Type, construction, working applications and selection criteria. Other Elements such as filters, manifold, receivers, coolers and connecters. Hydraulic Actuators- Type, working and applications. Control Valves- Type, designation, symbols, working and applications, Hydraulic Pipes- Type, materials, designations, pressure ratings and selection criteria. Piping Layout, Concept, rules/norms.

Unit-III

Fundamentals of Pneumatics: Compressible fluid flow, mass flow rate, compressible fluid- Type, properties and applications.

Unit-IV

Pneumatic Elements: Pipes- Type, applications and properties. Air Compressor- Type (Reciprocating and rotary), working and selection, Pneumatic Cylinders- Type, symbol, cushion, assemblies, mounting and, Pneumatic Valves- Type, symbols, working, applications and selection. Air Motors- Type, working and applications. Other Elements - Air receivers, filters, pressure regulator, lubricator.

Unit-V

Hydraulic and Pneumatic Circuits: Concept, Meaning and ISO symbols. Brief on designing of hydraulic and pneumatic circuits. Applications.

Text Books:

- Anthony Esposito," Fluid Power with Applications", PHI / Pearson Education, 2005
- Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.

Reference Books:

- Majumdar, S.R., “Pneumatic Systems – Principles and Maintenance”, Tata McGraw Hill, 2007.
- Srinivasan. R, "Hydraulic and Pneumatic Control", IInd Edition, Tata McGraw - Hill Education,2012.

Hydraulics & Pneumatics Lab

Subject Code: ME-605L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments

1. Design and testing of hydraulic circuits using
a) Pressure control
b) Flow control
c) Direction control.
2. Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro Hydraulic Trainer.
3. Design and testing of pneumatic circuits using
a) Pressure control
b) Flow control
c) Direction control
d) Circuits with logic controls
e) Circuits with timer’s
f) Circuits with multiple cylinder sequences in pneumatic electro pneumatic trainer.
4. Design of circuits using mechanical feedback systems.
5. Velocity control of single and double acting hydraulic and pneumatic cylinders.
6. Design of Pneumatic system using any commercially available simulation software.
7. Design of Hydraulic system using any commercially available simulation software.

Industrial Robotics & Material Handling System

Subject Code: RA-602

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- To discuss about the various applications of robots, justification and implementation of robot.

Learning Outcomes:

- Able to design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming.

Unit-I

Introduction: Types of industrial robots, Load handling capacity, general considerations in Robotic material handling, material transfer, machine loading and unloading, CNC machine tool loading, Robot centered cell.

Unit-II

Robots For Inspection: Robotic vision systems, image representation, object recognition and categorization, depth measurement, image data compression, visual inspection, software considerations.

Unit-III

Other Applications: Application of Robots in continuous arc welding, Spot welding, Spray painting, assembly operation, cleaning, robot for underwater applications.

Unit-IV

End Effectors: Gripper design,degrees of freedom.Types of end effectors & their uses.

Unit-V

Material Handling: Concepts of material handling, principles and considerations in material handling systems design, conventional material handling systems - industrial trucks, monorails, rail guided vehicles.

Text Books:

- Richaerd D Klafter, Thomas Achmielewski and Mickael Negin, “Robotic Engineering – An integrated Approach” Prentice HallIndia, New Delhi, 2001.
- Mikell P. Groover,”Automation, Production Systems, and Computer Integrated Manufacturing“, 2nd Edition, John Wiley & sons, Inc, 2007

Reference Books:

- James A Rehg, “Introduction to Robotics in CIM Systems”, Prentice Hall of India, 2002.
- Deb S R, "Robotics Technology and Flexible Automation", Tata McGraw Hill, New Delhi, 1994

Industrial Robotics & Material Handling System Lab

Subject Code: RA-602L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. Use of direction control valve and pressure control valves clamping devices for jig and fixture.
2. Study of robotic arm and its configuration.
3. Study the robotic end effectors.
4. Study of different types of hydraulic and pneumatic valves.
5. Study of reciprocating movement of double acting cylinder using pneumatic direction control valves.
6. Study of power steering mechanism using cut piece model.
7. Design and assembly of hydraulic / pneumatic circuit.

Human Values and Professional Ethics (MOOC/Online Course-IV)

Subject Code: OAE-101

Credit	Hours	Marks		
02	30	I	E	To
		30	70	100

Objectives:

At the end of course, students will attain

- Understanding of Human values for self (Niyama), and for interaction with outer world (Yama).
- Ability to exhibit Professional Ethics in performing a professional task with excellence – योग: कर्मसुकौशलम्
- Understanding of Professional Ethics that demands to see the unseen with emphasis on Sustainable development / eco-friendly implementation of the task.
- Ability to work in team with human values and professional ethics

UNIT I

Human Values-1: Morals, Values (Niyama): -Understanding values, Types of values, Role of tracking values for individual & social wellbeing. And Ethics (Yama):
Integrity: - Understanding integrity and role of integrity in social harmony –Trustworthiness
Work Ethics – Service-Learning – Civic Virtue – Respect for others – Living Peacefully –Caring – Sharing.
Honesty: -Understanding honesty and its role in personal and social –Courage – Value Time. Co-operation: -Understanding cooperation and significance of cooperation its family, work team and social cohesiveness, wellbeing and development – Commitment.
Tutorial Module: Rational Behavior versus Ethical Behavior: Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi) or any other literatures.

UNIT II

Human Values-2: Empathy: Basic **Concept on Empathy**– Self-confidence – Spirituality- Character.
Truthfulness: - Understanding truthfulness, need for truthfulness and role of truthfulness in relationship, social interaction, integrity, faiths & dependence – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties – Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence– Emotional Competencies – Conscientiousness.
Being, body, brain & mind: - Effective & efficient use of body, brain and mind is personal and social well being
Value Judgments, Facts & Values, how values are justified, Aesthetics, Selection of Values, Universal Values, Human Values, Value Education
Tutorial Module: Empathy and its types: Case Studies from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature.

UNIT III

Professional Ethics aiming at excellence and Harmony: Value Based Life and Profession, Professional Ethics and Right Understanding, Competence in Professional Ethics, Issues in Professional Ethics – The Current scenario.
Positive and constructive dynamism of power, politics and leadership.
Tutorial Module: Ethical decision making: Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature)

UNIT: IV

Professional Ethics: Global Prospective: Globalization and MNCs –Cross Culture Issues – Business Ethics – Media Ethics – Environmental Ethics – Endangering Lives – Bio Ethics – Computer Ethics – War Ethics

Tutorial Module: Ethics and Social Networks: Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature)

UNIT V:

Duties and Rights in Profession: Concept of Duty – Professional Duties – Collegiality – Techniques for Achieving Collegiality – Senses of Loyalty – Consensus and Controversy – Professional and Individual Rights – Confidential and Proprietary Information – Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes, Plagiarism

Tutorial Module: Ethics in Corporate: Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature)

REFERENCES:

1. **New Approaches in Ethics for the Caring Professions: Taking Account of Change for Caring Professions 2005 Edition,** by Richard Hugman **Publisher:** Red Globe Press; 2005 edition (9 July 2018)

2. **Rethinking Values and Ethics in Social Work 1st ed. 2017 Edition, Kindle Edition** by Richard Hugman (Author), Jan Carter (Author) **Publisher:** Red Globe Press; 1st ed. 2017 edition (16 September 2017)

3. **Professional Ethics and Human Values** Paperback – 2015 by A. Alavudeen (Author), R. Kalil Rahman (Author), M. Jayakumaran (Author) **Publisher:** Laxmi Publications; First edition (2015)

4. **A Foundation Course in Human Values and Professional Ethics** Paperback – 30 Apr 2010 by R.R. Gaur (Author), R. Sangal (Author), G.P. Bagaria (Author) **Publisher:** Excel Books (30 April 2010)

5. **Living Issues in Philosophy (9th Edition) (1995)** By: Titus, Smith and Nolan Publisher: Oxford University Press, New York

6. **Foundation of Ethics and Management** By: B P Banerjee, Publisher: Excel Books, 2005

Assessment Methodology

- Self-Assessment
- Peer Learning
- Assessment Rubries for Behavioural Skills
- Pedagogy:
- Case study based & Group Discussion.

Suggested reading:

Case Study: https://whitneyhess.com/blog/2012/08/21/on-empathy-and-apathy-two-case-studies/Book: De Gruyter - Speaking of Emotions: Conceptualisation and Expression (edited by Angeliki Athanasiadou, Elzbieta Tabakowska)

Book: To Kill a Mockingbird - Lee Harper

Book: Take A Walk In Someone Else's Shoes by Bethany Morlan

A paper on 'University Students' Value Priorities and Emotional Empathy':
file:///C:/Users/Dell/Desktop/University_Students_Value_Priorities_and_Emotiona.pdf

Research paper on 'Empathy as Added Value in Predicting Donation Behavior':
file:///C:/Users/Dell/Desktop/wp_10_692.pdf
Decety J and Jackson PL. 2004. The functional architecture of human empathy. Behavioral and cognitive neuroscience reviews 3(2):71-100.
Klimecki OM1, Leiberg S2, Ricard M2, Singer T3. Differential pattern of functional brain plasticity after compassion and empathy training. Soc Cogn Affect Neurosci. 2014 Jun; 9 (6): 873-9.
A paper on 'The Science of Empathy' - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5513638/
A paper on 'The Psychology of Emotional and Cognitive Empathy' - https://lesley.edu/article/the-psychology-of-emotional-and-cognitive-empathy
Links on the latest research and reviews on articles related to empathy - https://www.nature.com/subjects/empathy

Suggested videos/movies (English/Hindi)
The Boy in the Striped Pyjamas (an English movie based on the novel by the same name by John Boyne)
Chhapaak (an Indian movie about how a young woman tries to rebuild her life after a man throws acid in her face on a public street in New Delhi in 2005)
George Lucas Educational Foundation – Edutopia – 3 videos on the importance of empathy
- https://www.edutopia.org/blog/3-videos-importance-empathy
The actor, Mark Ruffalo, and Murray (from Sesame Street) talk about the word "Empathy"
- https://www.youtube.com/watch?v=9_1Rt1R4xbM
http://theconversation.com/understanding-others-feelings-what-is-empathy-and-why-do-we-need-it-68494
https://www.verywellmind.com/what-is-empathy-2795562
"The Present" is a thesis short from the Institute of Animation, Visual Effects and Digital Postproduction at the Filmakademie Baden-Wuerttemberg in Ludwigsburg, Germany.
- https://www.youtube.com/watch?v=96kI8Mp1uOU

Syllabus

(3rd Year-Fifth and Sixth Semester)

for

B.Voc. (Robotics and Automation)

Industry Partner: JBM Group

Batch: (2020-2023) onwards

Fundamentals of Artificial Intelligence (MOOC/Online Course-V)

Subject Code: OET-701

Credit	Hours	Marks		
02	30	I	E	To
		30	70	100

Course Objectives:

The objective of this course is to present an overview of the principles and practices of AI to address complex real-world problems. The course is designed to develop a basic understanding of problem solving, knowledge representation, reasoning and learning methods of artificial intelligence (AI).

Learning Outcomes

Students will able to

- learn and understand the principles and practices of AI, various searching techniques, constraint satisfaction problem, example problems- game playing techniques
- Acquire the knowledge of real-world knowledge representation
- Apply these techniques in applications which involve perception, reasoning and learning.
- learn and develop a basic understanding of planning and complex problem solving
- investigate applications of AI techniques in machine learning models.

Unit	Topic	Key Learning
I	AI and Problem Solving	Introduction to AI, Problem Solving as State Space Search, Uninformed Search, Problem Solving by Search: Heuristic Search, Informed Search, Constraint Satisfaction Problems, Searching AND/OR Graphs, Game Playing
II	Knowledge Representation	Knowledge Representation and Reasoning, Introduction to Knowledge Representation, Propositional Logic, First Order Logic and its inference, Answer Extraction, Procedural Control of Reasoning
III	Reasoning	Reasoning under Uncertainty, Bayesian Network, Decision Network
IV	Planning	Introduction to Planning, Plan Space Planning, Planning Graph and Graph Plan, Planning and Decision Making: Practical Planning and Acting, Sequential Decision Problems, Making Complex Decisions
V	Machine Learning	Introduction to Machine Learning, Learning Decision Trees, Linear Regression, Support Vector Machines, Unsupervised Learning, Reinforcement Learning, Learning in Neural Networks, Deep Learning

Text Books and References

1. Patrick Henry Winston, Artificial Intelligence, Third Edition, Addison-Wesley Publishing Company, 2004.
2. Nils J Nilsson, Principles of Artificial Intelligence, Illustrated Reprint Edition, Springer Heidelberg, 2014.
3. https://onlinecourses.nptel.ac.in/noc21_ge20/preview

Reference Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, PHI 2009.
2. Nils J. Nilsson, Quest for Artificial Intelligence, First Edition, Cambridge University Press, 2010.

*MOOC/Online Course-V (Cyber Security Tools Techniques and Counter Measures)

Subject Code: OET-702

Credit	Hours	Marks		
02	30	I	E	To
		30	70	100

Course Objectives:

The course Cyber Security, Tools, Techniques and Countermeasures aims to provide a foundational platform for Cyber Security Aspirants by providing Cyber Security Awareness and Training that heighten the chances of catching a scam or attack before it is fully enacted, minimizing damage to the resources and ensuring the protection of information technology assets.

Learning Outcomes

- Students will able be to acquire the knowledge of both the fundamentals of information systems as well as advanced topics in areas such as network security, cryptography, risk management, security governance, business continuity, security, architecture, physical security and critical infrastructures.

Unit	Topic	Key Learning
I	Introduction	Cyber Security Essentials, Attack Vectors, Threat, Risk and Vulnerability, Advanced Persistent Threat and Cyber Kill Chain, Cyber Security Framework
II	Firewall and Attacks on Wireless Networks	Firewall and Packet Filters, Introduction to Windows and Linux Firewall, Attacks on Wireless Networks, Scanning For Web Vulnerabilities Tools and HTTP Utilities
III	Inspection Tools and Security Policy	Application Inspection Tools, Password Cracking and Brute-Force Tools, Web Attack, Information Security Basics to Policy
IV	Detection System and Security Assurance	Intrusion Detection System, IT Assets and Wireless Security, Cyber Security Assurance Framework, Desktop Security and Malware
V	Social Engineering and IPR	E-Commerce and Web-Application Security, Social Engineering, Internet Crime and Act, Intellectual Property in the Cyber world

Text Books and References

1. Principles of Cyber Security Course Code: PGDCS-101 Published by Dr. Babasaheb Ambedkar Open University
2. Cyber Security Techniques: PGDCS-103 Published by Dr. Babasaheb Ambedkar Open University
3. https://onlinecourses.swayam2.ac.in/nou21_ge40/preview

Reference Books:

1. Cyber Security – Understanding Cyber Crimes, Computer Forensics and Legal Perspectives Author: Nina Godbole, Sunit Belapure, Publisher: Wiley India
2. Information Systems Security – Security Management, Metrics, Frameworks and Best Practices Author: Nina Godbole, Publisher: Wiley India

Consumer Affairs (MOOC/ Online Course-VI)

Subject Code: OAE-103

Credit	Hours	Marks		
2	15	I	E	To
		30	70	100

Objectives.

- This paper seeks to familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights. It also provides an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards.
- The student should be able to comprehend the business firms' interface with consumers and the consumer related regulatory and business environment.

Learning Outcomes

- Able to understand the conceptual framework of consumer affair
- Able to explain the consumer protection law in India
- Able to explain the Grievance Redressal Mechanism under the Indian Consumer Protection Law
- Able to explain the Role of Industry Regulators in Consumer Protection
- Able to explain the Contemporary Issues in Consumer Affairs

Unit-1 (Conceptual Framework)

Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labelling and packaging along with relevant laws, Legal Metrology.

Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite.

Unit-2 (The Consumer Protection Law in India)

Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice and restrictive trade practice.

Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions and National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

Unit-3 (Grievance Redressal Mechanism under the Indian Consumer Protection Law)

Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity andTelecom Services; Education; Defective Products; Unfair Trade Practices.

Unit-4 (Role of Industry Regulators in Consumer Protection)
Banking: RBI and Banking Ombudsman
Insurance: IRDA and Insurance Ombudsman
Telecommunication: TRAI
Food Products: FSSAI
Electricity Supply: Electricity Regulatory Commission
Real Estate Regulatory Authority

Unit-5 (Contemporary Issues in Consumer Affairs)
Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings.
Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview

Note: Unit 2 and 3 refers to the Consumer Protection Act, 1986. Any change in law would be added appropriately after the new law is notified.

Text Books:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. Consumer Affairs" (2007) Delhi University Publication; pp. 334/
2. Aggarwal, V. K. (2003). Consumer Protection: Law and Practice. 5th Ed. Bharat Law House, Delhi, or latest edition.
3. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
4. Nader, Ralph (1973). The Consumer and Corporate Accountability. USA, Harcourt Brace Jovanovich, Inc.

Reference Books:

1. Sharma, Deepa (2011). Consumer Protection and Grievance-Redress in India: A Study of Insurance Industry (LAP LAMBERT Academic Publishing GmbH & Co.KG, Saarbrucken, Germany; pp.263 pp.
2. Empowering Consumers e-book, www.consumeraffairs.nic.in
3. EBook www.bis.org
4. The Consumer Protection Act, 1986.

Linear Integrated Circuits

Subject Code: ECE-701

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To teach the theory of ADC and DAC.
- To introduce the concepts of waveform generation and introduce some special function ICs.

Learning Outcomes: Upon Completion of the course, the students will be able to

- Design linear and non-linear applications of op – amps.
- Design applications using analog multiplier and PLL.
- Design ADC and DAC using op – amps.
- Generate waveforms using op – amp circuits.
- Analyze special function ICs.

Unit-I

Basics of Operational Amplifiers: Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, slew rate, Open and closed loop configurations.

Unit-II

Applications of Operational Amplifiers: Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, Adder, Subtractor.

Unit-III

Analog Multiplier and Pll : Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable trans conductance technique, analog multiplier ICs .

Unit-IV

Analog to Digital and Digital to Analog Converters: Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type.

Unit-V

Waveform Generators and Special Functions: Sine-wave generators, Multivibrator and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator.

Text Books:

- D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.
- Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tata Mc Graw-Hill, 2007.

Reference Books:

- Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2001.
- Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
- B.S. Sonde, "System design using Integrated Circuits", 2nd Edition, New Age Pub, 2001

Linear Integrated Circuits Lab

Subject Code: ECE-701L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. To study the inverting operational amplifier (OP-AMP).
2. To study the non-inverting Op-Amp.
3. To study the Op-Amp as integrator.
4. To study the Op-Amp as differentiator.
5. To study the Op-Amp as Low Pass and High Pass filter
6. To study the Op-Amp as First order and second order filter.
7. To study the Op-Amp as summing, averaging and scaling.
8. To study Op-Amp as oscillator.
9. To study 555 as monostable multivibrator.
10. To study 555 as free running multivibrator.

Mobile Robots

Subject Code: RA-701

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the control of robots for some specific applications.

Learning Outcomes: Upon completion of the course, the student should be able to

- Understand basic wheel robot kinematics, common mobile robot sensors and actuators knowledge.
- Understand and able to apply various robot motion and sensor models used for recursive state estimation techniques.
- Demonstrate Inertial/visual odometeric techniques for mobile robots pose calculations.
- Use and apply any one of the Simultaneous Localization and Mapping (SLAM) technique.
- Understand and apply path planning and navigation algorithms.

UNIT-I

Introduction of Mobile Robots and Locomotion: A brief history of mobile robotics, Recent advances in the mobile robotics for RISE (Risky Intervention and Surveillance Environment) applications, Locomotion, Key issues in locomotion, legged, wheeled and aerial mobile robots.

UNIT-II

Mobile Robot Kinematics: Introduction, robot position, forward kinematic models, mobile robot workspace with degree of freedom, Holonomic robots, beyond basic kinematics, motion control (kinematic control)

Perception: wheel/motor encoders, heading/orientation sensors, ground based beacons, active ranging, motion/speed sensors, vision based sensors.

UNIT-III

Mobile Robot Localization: Introduction, The Challenge of Localization: Noise and Aliasing, To Localize or Not to Localize: Localization-Based Navigation versus Programmed Solutions, Map Representation and decomposition strategies, State of the art: current challenges in map representation, Probabilistic Map-Based Localization

UNIT-IV

Control of multiple robot: Principles and Problems of Multiple-Robot System, A Brief History of Multiple Robots, Control Issues in Autonomous-Robot Colonies, Case Study: Centralized Control of Very Simple Robot, Some Multiple-Robot Architectures, Swarm and Cellular Robotics, Communication among Multiple Robots, Formation Control, Robot Soccer, Heterogeneous Robot Teams

Unit V

Arduino: Introduction to Arduino, Pin configuration and architecture, Device and platform features., Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, Introduction to Embedded C and Arduino platform III, Review of Basic Concepts, Arduino data types, Variables and constants, Operators, Control Statements, Arrays, Functions Arduino I/O Functions, basics of Arduino programming

Text Books:

1. Roland Siegwart & Illah R. Nourbakhsh, "Introduction to autonomous mobile robots", Prentice Hall of India, 2004.
2. George A. Bekey "Autonomous Robots" MIT Press.
3. Howie Choset, Kevin M. Lynch, Seth Hutchinson, George A. Kantor, Wolfram Burgard, Lydia E. Kavrakiand Sebastian Thrun, "Principles of Robot motion: Theory, Algorithm and Implementations", MIT Press.

Reference Books:

1. Richard Szeliski: "Computer Vision: Algorithms and Applications", 2010 Springer.
2. Alexander Hornberg: "Handbook of Machine Vision", Wiley-VCH.

Mobile Robots Lab

Subject Code: RA-701L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

Outcomes:

1. To study about different types of robots such as line follower robot with and without Arduino (microcontroller)
2. To understand and apply different types of sensors in real time model
3. To learn and understand the working of different equipments.
4. To have a broader and wider understanding on problem recognizing and implementation of real-time projects
5. To learn about day to day applications of different kinds of robots

List of Experiments

1. **To study Line follower robot**
   Students will study different types of line followers such as with and without microcontroller, then assemble a line follower robot using Arduino. They will do Arduino programming by themselves for line follower.
2. **To study Bipedal Humanoid Robot**
   Students will study difference between legged and wheeled robot. They will assemble a robot having legged with Arduino. They will do Arduino programming by themselves for legged robot.

3. **To study Remote-Controlled Robot**

   Students will study different types of remote-controlled robot having joystick or Bluetooth, then assemble a robot having Bluetooth with Arduino using Arduino. They will do Arduino programming by themselves for the remote-controlled robot.

4. **To study Multipurpose Bot**

   Students will study how to use robotics in agriculture where lots of jobs are done at a time, then assemble a robot for the same.

5. **To study Balancing Robot**

   Students will study different types of balancing robots with and without Arduino, then assemble a robot having two wheeled with Arduino using Arduino. They will do Arduino programming by themselves for balancing robot.

6. **To study Self-Watering Plant robot**

   Students will study different types of self-watering robot having Arduino, then assemble a robot having Arduino using Arduino. They will do Arduino programming by themselves for self-watering plant robot.

Micro Electro Mechanical System

Subject Code: ME-701

Credit	Hours	Marks		
04	60	I	E	To
		30	70	100

Objectives:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering

Learning Outcomes:

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

Unit-I

Introduction to Microsystems: Overview of microelectronics manufacture and Microsystems technology. Definition - MEMS materials. Laws of scaling. The multi disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries.

Unit-II

Micro Sensors and Actuators: Working principle of Microsystems - micro actuation techniques - micro sensors – types – Microactuators – types – micropump – micromotors – micro – valves – microgrippers – microaccelerometers.

Unit-III

Fabrication Process: Substrates - single crystal silicon wafer formation – Photolithography – Ion implantation – Diffusion – Oxidation – CVD - Physical vapor deposition - Deposition epitaxy - etching process.

Unit-IV

Micro System Manufacturing : Bulk Micro manufacturing - surface micro machining – LIGA – SLIGA - Micro system packaging materials - die level - device level - system level - packaging techniques – die preparation – surface bonding - wire bonding - sealing.

Unit-V

Microsystems Design and Packaging: Design considerations, Mechanical Design, Process design, Realization of MEMS components using intellisuite. Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS.

Text Books:

1. Mohamed Gad – el – Hak, “MEMS Handbook”, CRC Press, 2002.
2. Rai - Choudhury P. “MEMS and MOEMS Technology and Applications”, PHI Learning Private Limited, 2009.

Reference Books:

1. Francis E.H. Tay and Choong .W.O, “Micro fluidics and Bio mems application”, IEEE Press New York, 1997.
2. Trimmer William S., Ed., “Micromechanics and MEMS”, IEEE Press New York, 1997.

Leadership & Quality Management

Subject Code: IMS-704

Credit	Hours	Marks		
04	75	I	E	To
		15	35	50

Objectives:

- To understand the need of quality and quality control
- Know about the importance of leadership skill in industries
- Understand the responsibilities of workmen for quality management in industry

Learning Outcomes:

- The purpose of this course is to put quality management into perspective, and to highlight its critical importance, as well as to present in-depth ideas on different methodologies, tools and techniques proposed for product and process improvement.

Unit-I

Concept of Leadership, Trait and Behavioural Approaches, Contingency Approach, Leadership and Values, Leadership Behaviour, Courage and Moral Leadership, Motivation and Empowerment, Leadership Diversity

Unit-II

Problem Solving Methods, Resource Management, Work effectively in a Team, Process and Product Quality Monitoring,

Unit-III

Evolution of Quality Management, Concepts of Product and Service Quality, Introduction to Process Quality, Graphical and statistical techniques for Process Quality Improvement,

Unit-IV

7 QC Tools, Control Charts, TQM, Benchmarking, Quality Audit, Quality Circles, OEM Guidelines, Quality Function Deployment

Unit-V

Robust Design and Taguchi Method, Design Failure Mode & Effect Analysis, Product Reliability Analysis, Case study on Six Sigma in Product Development, KaIzen, 5S, etc.

Suggested Readings:

- Daft, Richard L., Leadership, Cengage Learning India Pvt. Ltd., New Delhi.
- Hughes, Richard L, Robert C., Ginnett and Gordon J, Curphy, Leadership – Enhancing the Lessons of Experience, Tata McGraw Hill Co. Ltd, New Delhi
- D. C. Montgomery, Introduction to Statistical Quality Control, John Wiley & Sons, 3rd Edition.
- Mitra A., Fundamentals of Quality Control and Improvement,PHI, 2nd Ed., 1998.
- Besterfield, D H et al., Total Quality Management, 3rd Edition,Pearson Education, 2008.

Special Machines & Controllers Lab

Subject Code: EE-701L

Credit	Hours	Marks		
04	120	I	E	To
		70	30	100

List of Experiments:

1. Introduction to MATLAB/Simulink and control system toolbox.
2. Model DC motor and controllers (PI, PID) for speed control in MATLAB/Simulink
3. Study performance characteristics of DC motor.
4. Study performance characteristics of Stepper motor.
5. Study performance characteristics of Servo motor.
6. Study performance characteristics of Synchronous motor.
7. Study performance characteristics of single-phase transformer.
8. Perform DC, No-load and block rotor test of three-phase induction motor using MATLAB/Simulink
9. Implement controller to control position and speed of permanent magnet stepper motor
10. Speed Control of DC Servo Motor using PI, PID, Fuzzy and Sliding Mode Control

Robotic Design & Control

Subject Code: RA-703

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Unit-I

Introduction & Overview of Robotic Systems & Their Dynamics: Forward and inverse dynamics. Properties of the dynamic model and case studies. Introduction to nonlinear systems and control schemes.

Unit-II

System Stability & Types of Stability: Lyapunov stability analysis, both direct and indirect methods. Lemmas and theorems related to stability analysis.

Unit-III

Joint Space & Task Space Control Schemes: Position control, velocity control, trajectory control and force control.

Unit-IV

Nonlinear Control Schemes: Proportional and derivative control with gravity compensation, computed torque control, sliding mode control, adaptive control, observer based control, robust control and optimal control.

Unit-V

Nonlinear Observer Schemes: Design based on acceleration, velocity and position feedback.

Numerical simulations using software packages namely MATLAB/MATHEMATICA.

Text Books:

1. R Kelly, D. Santibanez, LP Victor and Julio Antonio, —Control of Robot Manipulators in Joint Space‖, Springer, 2005.

2. A Sabanovic and K Ohnishi, —Motion Control Systems‖, John Wiley & Sons (Asia), 2011.

Reference Books:

1. J J Craig, —Introduction to Robotics: Mechanics and Control‖, Prentice Hall, 2004.

2. Sebastian Thrun, Wolfram Burgard, Dieter Fox, —ProbabilisticRobotics‖, MIT Press, 2005.

Robotic Design & Control Lab

Subject Code: RA-703L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. Forward and Inverse kinematics of two axis planar articulated robot using analytical and DH algorithm using Lego NXT.

2. Forward and Inverse kinematics to control hand movements in NAO.

3. Study and selection of Gripper.

4. Implementation of trajectory planning algorithm for straight line motion using Matlab and executing PID based control of two axis planar articulated robot in Lego NXT.

5. Analysis and Simulation using Fanuc Robo guide software and real time Programming of Fanuc M 710i robot.

6. Programming of Adept Cobra S 600 SCARA robot.

Power Electronics & Drives

Subject Code: EE-702

Credit	Hours	Marks		
03	45	I	E	To
		15	35	50

Objectives:

- To get overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated invertors and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

Learning Outcomes:

- Ability to understand and analyze, linear and digital electronic circuits.
- Ability to understand the various drives used in industries.

Unit-I

Review of Power Semiconductor Devices: Power diodes – Power transistors – Characteristics of SCR, TRIAC, Power MOSFET, IGBT.

Unit-II

Converters: Single phase – Three phase – Half controlled – Full controlled rectifiers – Dual converters – Effect of source and load inductance – AC regulators.

UNIT-III

Inverters: Voltage Source inverters –bridge inverters, Current source inverters – voltage and waveform control of inverters.

UNIT-IV

Choppers: DC choppers – step up and step down – uninterrupted power supplies. INTRODUCTION TO DRIVES Basic Elements of Drive – Load characteristics – Selection of Drive

UNIT-V

DC Drives: Basic characteristics of DC motor – Operating modes – quadrant operation of chopper – Closed loop control of DC drives.

Text Books:

- Rashid M H, "Power Electronics – Circuits, Devices and Applications", PHI, New Delhi, 2004.
- Dubey G K, "Power Semiconductors and Drives", Prentice Hall, 1989.

Reference Books:

- Bimal K Bose, "Modern Power Electronics and AC Drives", Pearson Education, 2002.
- Mohan and Udeland and Robbins, "Power Electronics", John Wiley and sons, New York, 2003.

Power Electronics & Drives Lab

Subject Code: EE-702L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments

1. Gate Pulse Generation using R, RC and UJT.
2. Characteristics of SCR and TRIAC
3. Characteristics of MOSFET and IGBT
4. AC to DC half-controlled converter
5. AC to DC fully controlled Converter
6. Step down and step up MOSFET based choppers
7. IGBT based single phase PWM inverter
8. IGBT based three phase PWM inverter
9. AC Voltage controller
10. Switched mode power converter