

VEER NARMAD SOUTH GUJARAT UNIVERSITY



PG DIPLOMA IN INDUSTRIAL AUTOMATION

Semester-I

Sr. No.	Subject Code	Subject Name	Scheme		Marks	
			L	P	L	P
1	IA 101	Industrial Automation	3	9	100	150
2	IA 102	Industrial Instrumentation – I	3		100	
3	IA 103	Industrial Power Electronics	3		100	
4	IA 104	Microcontrollers and Embedded System Design	3		100	
5	IA 105	Process Control	3		100	
6	IA 106	Project	0	3	0	50
TOTAL			15	12	500	200

Minimum Marks required for passing is 40% in each theory papers, practical and project separately.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Semester-I

IA 101 INDUSTRIAL AUTOMATION

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.

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.

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.

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.

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

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Semester-I

IA 102

INDUSTRIAL INSTRUMENTATION – I

Introduction to measurements and instrumentation: Static and dynamic characteristics of instrumentation, operational modes of instrumentation, measurement standards.

Signal Processing Elements and Signal Conditioning: Amplifiers, V-I converter, I-V converters, V-F converters, F-V converters, Modulation, Filters, ADC, DAC, Telemetry, Isolation techniques.

Measurement of process variables (Temperature, Flow, Pressure, Level): Types, Application and Selection.

Electromagnetic Compatibility: Grounding and shielding, EMI and EMC testing

Text/References:

- DOEBLIN: Measurement Systems: Application and Design, TMH
- LIPTAK: Instrumentation Engineering Handbook, Chilton Book Company
- T. H. RATHORE: Digital measurement techniques
- R. K. JAIN: Mechanical and Industrial Measurements, Khanna Publishers.
- PATRANABIS: Principle of Industrial Instrumentation, TMH
- W. G. ANDREWS: Applied Instrumentation in Process Industries (Volume I & II), Gulf Book
- JOHN G. WEBSTER: The Measurement, Instrumentation and Sensors Handbook, CRC Press

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Semester-I

IA 103

INDUSTRIAL POWER ELECTRONICS

Introduction to power switching devices: Thyristor, Triac, MOSFET, IGBT their characteristics, internal structure, firing circuits, protection scheme including snubber, mounting requirements.

Phase Controlled Rectifiers: single phase bridge rectifier with R, RL and RLE load, three phase semi-converter, three phase full-converter, dual converter, harmonic issues in controlled rectifiers.

Inverters: single phase bridge inverter, three phase bridge inverter, 120 and 180 degree mode of operation, voltage and frequency control in inverters, different methods of PWM, harmonic elimination with PWM, performance parameters.

DC - DC Converters: Principle of operation of buck, boost, buck-boost, Flyback, Input & output filter design.

AC voltage controllers: single phase and three phase ac voltage controllers, harmonic performance, different topologies for three phase controllers.

Modeling of Power Electronics converters: PSIM / pSpice / Matlab.

Power electronics for Induction heating and welding

Introduction of UPS: online and offline systems, UPS architecture, Battery bank management.

Text/References:

- NED MOHAN TORE. M. UNDELAND & WILLIAM. P. ROBBINS; "Power Electronics: Converters, Applications and Design", 3rd Edition, John Wiley and Sons, 2003
- RASHID M. H, Power Electronics – Circuits, Devices and Applications", PHI / Pearson Education, 3rd Edition, 2004.
- B. K. BOSE: Power Electronics and AC drives, Prentice Hall, 1986
- S. N. SINGH: Power Electronics:

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Semester-I

IA 104

MICROCONTROLLERS AND EMBEDDED SYSTEM DESIGN

Introduction to microcontrollers: difference between microprocessor & microcontrollers, different microcontroller families and applications, overview of 8, 16 and 32 bit microcontroller architecture; embedded system overview.

Introduction to 8051 family architecture: 8051 pin diagram, 8051 architecture, special function registers, programming model, internal memory structure, on-chip peripherals, and external memory interfacing and interrupts.

Assembly language programming: data transfer instructions, arithmetic instructions, logical instructions, bit manipulation instruction and program flow control instructions.

Introduction to Software Development tools: introduction to cross compilers, assemblers, linkers and debuggers; introduction to assembler directives; introduction to emulators and other debuggers.

Embedded 'C' programming: introduction to embedded C, data types, device drivers programming and C library functions.

Study of interfacing technique and peripherals: interfacing peripherals like external memory, keyboard, display modules, ADC, DAC, stepper motors and serial port.

Serial Communication: serial communication modes and applications.

Software architectures for Embedded Systems: embedded system architectures like round robin, round robin with interrupts and introduction to RTOS

Advanced Microcontrollers: introduction to advanced microcontroller families like ARM, AVR, PIC and MSP430.

Text/References:

- KENETH AYALA: The 8051 Microcontroller Architecture & Programming, Thomson Learning.
- S. K. SHAH: Microcontrollers Programming & Interfacing.
- VALVANO: Introduction to **Embedded** Microcomputer Systems

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Semester-I

IA 105 PROCESS CONTROL

Introduction to Process Control System: Process dynamics, Degree of freedom of a process.

Sample Data System: Process modeling for sampled data system, Time domain and frequency domain modeling, Z-Transformation.

Control System Components: Electrical, Pneumatic and Hydraulic systems modeling.

Control Modes: P, I, D control, Evaluation, Tuning of controllers.

Control Strategies: Feedback control, Feed Forward Control, Ratio Control, Cascade Control, Over-ride control, Optimizing control system, Computed variable control system.

Control of Packaged systems: Boiler, Turbine, Heat Exchanger, Distillation Column (Case Studies)

Text/References:

- ANDREWS: Applied Instrumentation in Process Industries (Volume-IV)
- D. PATRANABIS: Principles of Process Control, TMH
- LIPTAK: Process Control
- C. D. JOHNSON: Process Control Instrumentation
- S. K. Singh: Computer aided process control, PHI
- B. C. KUO: Automatic Control System, PHI
- K. OGATA: Discrete Time Control System, Pearson Education India

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Semester-I

Proposed List of Practicals for PG Diploma in Industrial Automation

1. Introduction to software development tools.
2. Introduction to assembly language programming.
3. Write an assembly language program to toggle a relay at 1sec using timer 0 interrupt.
4. Write a 'C' program to interface Seven Segment displays.
5. Write a 'C' program to interface Matrix Keyboard.
6. Write a 'C' program to interface 16x2 LCD modules.
7. Write a 'C' program to interface Analog to Digital Converters & Digital to Analog Converters.
8. Write a 'C' program to vary speed of DC motor using PWM.
9. Write a 'C' program to interface PC through RS232 port.
10. Study of PLC architecture and connection details.
11. Introduction to bit logic instruction set - I.
12. Introduction to bit logic instruction set - II.
13. Study of PLC timers with ladder programming.
14. Study of PLC counters with ladder programming.
15. Introduction to PLC arithmetic and logical instructions - I.
16. Introduction to PLC arithmetic and logical instructions - II.
17. Study of PLC interrupts.
18. Introduction to PLC program control instructions - I.
19. Introduction to PLC program control instructions - II.
20. Communication of PLC with PC with Free Port Protocol.
21. Introduction to Analog value processing on PLC.
22. Mini Project on Industrial Problem.
23. Design a signal conditioning block for given input output relationship.
24. Study of instrumentation amplifier.
25. Study of V to I & I to V converters.
26. Study of isolation techniques.
27. Study of standard signals.
28. Study of pneumatic actuators and pneumatic system.
29. Study of temperature & pressure sensors.
30. Study of firing circuits for Thyristors using opto-coupler and pulse transformer.
31. Study of driver ICs for MOSFET & IGBT.
32. Study of PWM IC LM 3524.
33. Study of harmonics in power system.
34. Study of three phase inverter.
35. Study of AC voltage controller.
36. Study of induction heating.
37. Study of DC-DC converter.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Practical List (Semester I)

1. Introduction to CAD/MCAD Packages, GUI/Global trends in CAD Industry.
2. GUI & Sketcher Environments.
3. 3D Modeling Commands.
4. 3D Editing Tools.
5. Surfacing
6. Pull Down Menu Options
7. Misc. Command (Family of Part, Design Sensors, Library etc.)
8. Assembly I
9. Assembly II / Exploded View
10. Drafting I
11. Drafting II
12. Sheet Metal Design
13. Motion
14. Query Session
15. Project feasibility study and Project selection for design and development
16. Project : Punching machine (With motion)
17. Project : Fuel tank of bike
18. Project : Mouse
19. Project : Ordinary CRT Monitor
20. Project : Helmet
21. Project : Mobile Phone
22. Project : Wheel rim and Tyre design
23. Project : Wrist watch (Including gear system) (With motion)
24. Project : Motion of I.C. Engine
25. Project : Various types of Cams and Gears
26. Introduction to CAM Packages, GUI/Global trends in CAD/CAM Industry
27. GUI & Environments, The operation navigator, Objects, Operations, Post processing, Shop Documentation.
28. Planer milling, Profile milling, Planer milling single level, Planer milling Multi-level, Planer milling-multi region.
29. Face milling, Cavity milling, Z-level milling.
30. Surface contouring, Area milling drive methods
31. Flow cut drive method; Radial cut drive method, Engraving.
32. Spiral drive method, Surface area drive method.
33. Introduction to turning operations, Lathe cross- sections, Common turning parameters.
34. Rough turn, Finish turn, Centerline drilling, Groove OD, Thread OD.
35. IPW Management for Multiple spindles.
36. Drilling, Fixed axis drilling,
37. Multi axis drilling, drilling patterns.
38. Query Session
39. Project feasibility study and Project selection for computer aided manufacturing
40. Project : Milling
41. Project : Lathe
42. Project: Drilling