Programme Code: **IS**									
Course Code: **IS 11 213**			Course Title: **Process Measurement**						
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
4	**--**	**2**	**6**	**80**	**20**	**--**	**50**	**--**	**150**

Note:

1) PR/OR marks with (*) indicates an assessment by Internal and External examiners, while PR/OR marks without (*) indicates an assessment by Internal examiner only.
2) TW marks by Progressive Assessment**.**
3) Theory paper duration is 03 Hrs. and term test duration is 01 Hr.
4) Theory Paper assessment by Internal and External examiners.

Rationale:

Measurement of physical quantities/process parameters is necessary in industries. Hence it is essential to study fundamental concepts and basic information about transducers. Instrumentation engineer plays a vital role in monitoring & controlling processes, improving operator efficiency & ensuring plant protection.

Objectives: - Students will able to

1. Understand principle and construction of transducers
2. Draw the diagram of different transducers.
3. Draw the Input/output characteristics of different transducers.
4. Understand principle of process measurement systems.
5. Measure the process parameters such as pressure, temperature, flow etc.
6. Identify the specifications of transducers.
7. State the advantages and disadvantages of transducers.
8. Select & calibrate transducer.

Section I			
Ch. No.	**Contents**	**Hours**	**Marks**
1.	**Non electrical-type Temperature Measurement** 1.1 Temperature: definition, temperature scales, International Practical Temperature Scale (IPTS. 1.2 Filled system thermometers 1.3 Bimetallic strip thermometers (Principle, type of fluid/material used, types ,construction, working, range, advantages and disadvantages.)	06	08
2.	**Electrical -type Temperature Measurement** 2. 1 Resistance Temperature Detectors (RTDs). 2.2 RTD measurement circuits: 3-wire and 4-wire compensation circuits. 2.3 Thermistor s. 2.4 Thermocouples-Principle, thermocouple effects and laws 2.5 Thermopile, T/c cold junction compensation techniques 2.6 Thermocouple tables, characteristics, and calibration methods. 2.7 Pyrometers: Radiation and optical. 2.8 Integrated-Circuit Temperature Sensors. (Principle, construction, working, materials, range, application, advantages & disadvantages.)	14	16
3.	**Pressure Measurement** 3.1 Definition, different types of pressure. 3.2 Manometers: U-tube-type, well -type, inclined manometers, and barometer. 3.3 Elastic pressure sensors/ pressure gauges: Bourdon tubes, bellows, diaphragms. 3.4 Measurement of vacuum: McLeod gauge, thermal conductivity gauge, pirani gauge, thermocouple gauge. 3.5 Electronic pressure sensors: strain gauge-type, capacitive-type, inductive-type, and piezo-electric-type pressure sensors. (Diagram, construction, operation, selection criteria ,advantages, and applications and above pressure transducers.) 3.6 Pressure transmitter applications. 3.7 Calibration of pressure transducers using U-tube manometer and dead weight tester.	12	16

Section II			
Ch. No.	**Contents**	**Hours**	**Marks**
5.	**Level Measurement** 5.1 Sight-type Instruments: Glass gauges, displacers, tape float 5.2 Pressure-type Instruments: Differential pressure, bubblers, and Diaphragm. 5.3 Electrical- Instruments: Capacitance probes, resistance tapes, and conductivity probes. 5.4 Sonic- type Instruments: Ultrasonic –type level measurement 5.5 Radiation-type Instruments: Nuclear –type , microwave-type, and radar-type level measurements. (Diagram, construction, operation, selection criteria, advantages & applications of above transducers and switches.)	12	14
6.	**Flow Measurement** 6.1 Flow principles: Brenoulli's law, flow through process pipe-equation, Reynold's number and flow types. 6.2 Flow-meters classification 6.3 Variable head flowmeters: Orifice plates, venturi-meter, flow nozzle, pitot tubes, and annubar. 6.4 Variable area flowmeter: Rotameter. 6.5 Velocity-type flowmeters: Turbine-type , magnetic –type , votex shedding type, ultrasonic c type flow meters. 6.4 Positive-Displacement Flowmeters: rotary-vane and nutating-disk type flowmeters. 6.5 Coriolis Mass flowmeters. 6.6 Flow meter selection procedure & example. (Diagram, construction, operation, selection criteria, advantages & applications of above transducers.)	16	20
7.	**Humidity Measurement** 7.1 Definition: absolute and relative humidity. 7.2 Calculation of Relative Humidity & example. 7.3 Hygrometer: Hair hygrometer. 7.4 Wet and dry bulb Hygrometer: sling psychrometer. (Diagram, construction, operation, selection criteria, advantages & applications of above transducers.)	04	06

List of Practicals:

1.Plot the characteristics of PT-100 (Temp. Vs. Resistance)

2.Plot the characteristics of Thermocouples (Temp. Vs. Voltage):
J - type , K - type , T - type, S andr R - type .

3. Plot the characteristics of Thermistor (Temp. Vs. Resistance**)**

4. Pressure measurement Using
   i. Well/ U-tube/ inclined tube manometers
   ii. Bourdon Tubes– C type, Helical type, Spiral type
   iii. Capsules Bellows

5. Level measurement Using
   i. Capacitive transducers
   ii. Bubbler method
6. Flow measurement
   i. using orifice meter and manometer.
   ii. using Rotameter.
   iii. Using DP cell
7. Humidity measurement using digital hygrometer
8. Level measurement using DP transmitter.
9. Calibration of pressure gauge by using dead weight pressure gauge tester.
10. Calibration of temperature transducers.

Reference Books:

Sr. No.	Name of Book	Name of Author	Edition	Publication
1.	Measurement and Control Basics	**by Thomas A. Hughes**	Third Edition	**ISA Press**
2.	Instrumentation Measurement and Analysis	**Nakra, Chaudhari**	Second Edition	Tata McGraw Hill
3.	Transducers and Instrumentation	**D.V.S. Murthy**	Eastern Economy Edition(EEE)	Prentice Hall India
4.	Instrumentation Devices and Systems	**Rangan , Mani , Sharma**	Second Edition	Tata McGraw Hill
5.	Industrial Instrumentation and control	**S.K.Singh**	Second Edition	Tata McGraw Hill
6.	A Course in Electrical and Electronics Measurement and Instrumentation	**A. K. Sawhney**	Seventh Edition	Dhanpat Rai & Co
7.	Principles of Industrial Instrumentaion	**D. Patranabis**	Second Edition	Tata McGraw Hill
8.	Instrument Engineers Handbook **Vol . Proecss Measurement**	**Bela G. Liptak.,Kriszta Venczel**	Revised Edition	-----

Programme Code: **IS**									
Course Code: **IS 11 301**			Course Title: **Linear Integrated Circuits and Applications**						
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
4	**--**	**2**	**6**	**80**	**20**	**50***	**--**	**--**	**150**

Note:

1) PR/OR marks with (*) indicates an assessment by Internal and External examiners, while PR/OR marks without (*) indicates an assessment by Internal examiner only.
2) TW marks by Progressive Assessment**.**
3) Theory paper duration is 03 Hrs. and term test duration is 01 Hr.
4) Theory Paper assessment by Internal and External examiners.

Rationale:

One of the most versatile and widely used electronic device in linear applications is the operational amplifier, most often termed as the Op-Amp. Op- Amps are popular because they are cheap, easy to use and fun to work with. One can built using Op-Amp without the need to know about their complex internal circuitry. Op-Amps are used in the field of process control, power, communication, computers, signal sources, displays and testing or measuring systems. This course covers principles, construction, applications of commonly used linear IC's.

Objectives: - Students will able to

1. Test the different Op-Amp circuits.
2. Define Op-Amp parameters (Characteristics).
3. Draw different analog circuits using Op-Amp.
4. Explain the operation of Linear circuits.
5. State specifications , output equations of Op-Amp.
6. Understand the principle & operation of Linear IC's.
7. Develop the application circuits using Op-Amp.

Section I			
Ch. No.	**Contents**	**Hours**	**Marks**
1.	**Introductions** 1.1 Importance of Op-Amp 1.2 Circuit symbols & Terminals 1.3 Block diagram (different stages) 1.4 Functions of different stages 1.5 Definitions of parameters of Op-Amp Input offset voltage, Input offset current, Input bias current, Differential Input resistance. Input capacitance, Offset voltage adjustment Range ,	10	11

	Input voltage range, CMRR, Supply voltage rejection ratio, Large Signal voltage gain, output voltage swing, Output resistance , Output short circuit current , Supply current ,Slew rate, Gain bandwidth product. 1.6 Ideal Op-Amp :- electrical characteristics 1.7 Ideal voltage transfer curve 1.8 Comparison of Op-Amp ICs 741, OP-07, LF-356 1.9 Open loop Op-Amp configurations. 1.10 Basic concept of frequency compensation of Op-Amp. 1.11 Dual power supply connections. 1.12 FET based Op-Amp. 1.13 Need for signal conditioning, signal processing		
2.	**Op-Amp circuits** 2.1 Inverting 2.2 Non – Inverting 2.3 Unity gain follower 2.4 Adder/ Subtractor/ Scalar/Averaging Amplifier 2.5 Differential amplifier 2.6 Integrator 2.7 Differentiator Circuit diagram, circuit operation, equation, applications	09	11
3.	**Instrumentation Amplifiers** 3.1 Features, requirement 3.2 Block Diagram and Operation 3.2 Circuit diagram & Voltage output equation – using Two & Three Op-amp. 3.3 Advantages 3.4 Features and characteristics diagram of any one modular IC 3.5 General purpose op-Amps and Instrumentation Amplifiers Applications: 3.51 Thermal sensor conditioning − design considerations and applications for RTD, thermocouple. 3.52 Optical sensor conditioning-photoconductor, photovoltaic. 3.53 Other Sensors conditioning – LVDT, strain gauges.	06	09
4.	**Timers** 4.1 Need of timers, features 4.2 Block diagram. 4.3 Operation. 4.4 IC 555 pin diagram, pin functions 4.5 IC 555 as a Monostable multivibrator a) Circuit and operation b) Output Wave form, output equation, duty cycle c) Application : frequency divider 4.6 IC 555 Astable multivibrator a) Circuit & operation. b) Output voltage waveform,Output equation , duty cycle. c) Application :- Square wave oscillator.	07	09

Section II			
Ch. No.	**Contents**	**Hours**	**Marks**
5.	**Applications of Op- Amps** 5.1 Voltage to current converter with floating load 5.2 Current to voltage converter 5.3 Logarithmic Amlifier 5.4 Antilogarithmic amplifiers 5.5 Multiplier 5.6 Divider 5.7 Sample & hold circuit 5.8 Constant current Source 5.9 Constant Voltage Source 5.10 Multiplexer 5.11 Square wave generator 5.12 Schmitt trigger circuit 5.13 Clamping circuit 5.14 Zero crossing detector 5.15 Comparator 5.16 Precision amplifier 5.17 Voltage to frequency converter. Circuit diagram, Circuit operation, Output equation, Output waveforms, applications.	12	13
6.	**Active filters** 6.1 Advantages of active filters over passive filters 6.2 Types of filters : a) Low pass (first order Butterworth) b) High pass (first order Butterworth) c) Band pass first order d) Band reject filters e) All pass filters circuit f) Op-Amp Filter IC Circuit diagram, circuit operation, frequency response, .applications.	07	08
7.	**Phase Lock Loop (PLL)** 7.1 Block diagram 7.2 Operation 7.3 Component details :- Phase detector, low pass filter, voltage controlled oscillator 7.4 Transfer characteristics : Lock range, output range, bandwidth, transient response 7.5 IC 565 : pin diagram, pin functions 7.6 Applications of PLL: - frequency multiplier, frequency synthesisor.	07	09
8.	**Voltage Regulators** 8.1 Need of voltage regulators 8.2 Classification :		

	a) Polarity b) Terminal c) Fixed or adjustable output voltage d) Output current 8.3 Common characteristics 8.4 Fixed voltage regulators : Positive & negative (IC 78 XX & IC 79 XX) a) Terminals b) Rating c) 7805 as a current source d) Applications	**06**	**10**

List of Practicals (Any eight)**:**

1) To find & test parameters of OP-Amp.
2) To assemble the circuit of Inverting & Non- Inverting Op-Amp & to find its output voltage .
3) To assemble the Instrumentation amplifier circuit & find the gain of it.
4) To Determine time cycle of IC 555 Timer as monostable/astable multivibrator .
5) To determine free running frequency (f (OUT)) Lock range (fL). Capture range (fC) of PLL IC 565 for a sample circuit.
6) To construct & test the 0.5A current source using regulator IC 7805.
7) To observe the response of first order low pass butterworth filter using OP- Amp.
8) To observe the input & output waveforms of non-inverting comparator.
9) Assemble the circuit of V to I / I to V converter & plot the graph of Input- output .
10) To find the output of adder/ subtractor/scalar circuit.
11) Assemble the Integrator & differentiator circuit & test it's output.
12) Build the adjustable voltage regulator circuit for following specifications:

    Output voltage - 5 to 12 V

    Output current - 1.0 AMP

13) To assemble logarithmic & antilogarithmic amplifier & test its output.
14) To design the signal conditioning circuit for RTD.
15) To design the signal conditioning circuit for Thermocouple.
16) To design the signal conditioning circuit for LVDT/Strain guage/Photo diode/ Photo conductors.

Reference Books:

Sr. No.	Name of Book	Name of Author	Edition	Publication
1.	Op-Amp & Linear Integrated circuits	Ramakant A. Gaiyakwad	Third edition	Prentice Hall of India
2.	Operational amplifiers with Linear integrated circuits	William Stanley	----	CBS
3.	Operational amplifiers	G. B. Clyton	Second Edition	ELBS
4.	Operational amplifier & Linear Integrated circuits	Coughlin & Dirscoll	Fourth Edition	Prentice Hall of India
5.	Integrated Circuits	: K. R. Botkar	------	Khanna
6.	Operational Amplifier	Arpad Barna Dan I.Porat	Second Edition	A Wiley-Intersence
7.	Application and Design with Analog Integrated Circuit	J.Michael Jacob	Second Edition	Prentice Hall of India
8.	Process control Instrumentation Technology	C. D. Johnson	Seventh Edition	Eastern Economy Edition

Programme Code: **IS / EC/ CE/ CO/ME/ IT/ LG/ LT/ RT**									
Course Code: **ME11 208**			Course Title: **Computer Aided Graphics**						
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
--	**--**	**2**	**2**	**--**	**--**	**--**	**--**	**50**	**50**

Note:

1) PR/OR marks with (*) indicates an assessment by Internal and External examiners, while PR/OR marks without (*) indicates an assessment by Internal examiner only.
2) TW marks by Progressive Assessment**.**
3) Theory paper duration is 03 Hrs. and term test duration is 01 Hr.
4) Theory Paper assessment by Internal and External examiners.

Rationale:

The Computer Aided Drafting software has become a vital part of engineering drawings as it facilitates to draw neat, precise and fast drawing. The CAD Software not only enhances the speed and quality of drawing but it also allows editing the existing drawings at a very convenient way. It is easy to store and handle drawing and printouts can be obtained at any point of time. For this reason the industries now are demanding a diploma holder with knowledge of CAD. Therefore the course is worth to be included in the curriculum.

Objectives: Students will able to create new drawings using Any CAD software, so that they can draw various objects using line, arc, circle, ellipse, hatching like features, and can draft engineering objects.

Section I			
Ch. No.	**Contents**	**Hours**	**Marks**
1.	**Basic of CAD** Introduction to CAD interface, main window, commands prompt and help, Preamble to use of grid, snap, Ortho, Osnap, WCS, UCS, Object properties: style of line, line type, zoom, pan, move, align, rotate, setting up a drawing environment .	04	
2.	**Getting Started** How to use a mouse, Concept of CAD interface; its toolbars, menus, curser menu, the command window, the text window, accessing commands using a toolbar, using a menu and using command prompt Modifying CAD environment, setting environment preferences, controlling warnings, saving drawing automatically, selecting colors for the CAD, Skill to opening existing drawings: open, browsing through files, searching for files, saving drawings and exiting CAD .	06	
3.	**Organizing the Project** Setting drawing limits, unit style, grid limits, snap spacing, borders and title blocks, Organizing information on layers: planning layers, creating and naming layers, using line types, loading line types, Use of the templates, creation of the templates, recovering the default templates .	04	

4.	**Coordinate Systems in CAD** Concept of Cartesian and Polar coordinate systems: specifying Cartesian and polar coordinates, Use of the direct distance entry, Shifting and rotating the coordinates system: shifting the XY plane, locating a new UCS origin, restoring the UCS to WCS, displaying the UCS icon, saving and reusing a UCS .	02	

Section II			
Ch. No.	**Contents**	**Hours**	**Marks**
5.	**Creating Objects** Drawing lines: line types, making line type current, renaming line type, deleting line types, changing line type description, filtering line types, Drawing poly-lines using PLINE, MLINE, Drawing polygons (inscribed & circumscribed), Drawing spline curves, circles (center, radius; tan, tan, radius), Arcs (3 points; start, center, length; center, start, center, angle; center, start, angle; center, start, length; start, end, direction, start, end, radius), Ellipses: axis, end; arc, Creating point objects, Creating composite regions, boundary, union, intersect, Hatching areas as associative hatch, defining hatch boundaries, using hatch styles, using hatch patterns.	06	
6.	**Drafting with Precision** Adjustment of snap and grid alignment: change the snap angle and base point, using isometric snap and grid, Use of the Ortho mode, Snapping geometric points on objects: object snaps-endpoint, midpoint, intersection, apparent intersection, center, quadrant, node, insertion, perpendicular, tangent, nearest, quick, none, Setting of the object snaps .	02	
7.	**Modifying/Editing Tools** Renaming objects, Selecting objects, Using groups, Editing colors, Editing line types, Matching properties of other objects, Copying objects: coping within a drawing, multiple copying using grips, copying with the clipboard, Offset, Mirror, Array, Move, stretching objects scaling objects, extending objects, trimming objects, Inserting breaks in objects, Explode, Chamfering, Fillet .	06	
8.	**Dimensioning Concepts** Dimension style, dimension text, leader lines, associative dimensions (Linear dimensions, Radial dimensions, Ordinate dimensions, baseline and continued dimension leaders and annotation), Editing dimensions .	02	

List of Assignments/ Activities to be performed:

1. Assignment to demonstrate the use, interface and handling and operating functions of any CAD software.
2. Assignment based on standard tools in CAD software.
3. Assignment based on grid, layer, templates in CAD software.
4. Assignment based on Coordinate systems in CAD.
5. Assignment based on drawing tools available in CAD.
6. Assignment based on modifying tools available in CAD.
7. Assignment based on dimensioning facilities available in CAD.

(**Important Note:** All above assignments should be supported with 5 drafting assignments of objects from any standard Engineering drawing book).

Reference Books:

1. Autodesk's user's guide by Autodesk team.
2. QCad documentation (Check website related software).
3. Free CAD documentation (Check website related software).

Programme Code: **IS**									
Course Code: **IS 11 309**				Course Title: **Power Electronics**					
Compulsory / Optional: **Optional**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
4	**--**	**2**	**6**	**80**	**20**	**--**	**--**	**50**	**150**

Note:

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2) TW marks by Progressive Assessment**.**
3) Theory paper duration is 03 Hrs. and term test duration is 01 Hr.
4) Theory Paper assessment by Internal and External examiners.

Rationale:

Power electronics is interdisciplinary and is at the confluence of three fundamental technical areas - power, electronics and control. A simple definition for power electronics would be "the control of `raw' input electrical power through electronic means to meet load requirements". Power electronics is interdisciplinary in nature and is used in a wide variety of industries from computers to chemical plants to rolling mills.

Objectives: - Students will able to

1. Understand the construction of thyristors.
2. Understand the working principle of thyristors, converter & inverter circuits.
3. Selection of thyristors for particular application.
4. Design and implementation of thyristors for power applications.
5. Design and implementation of thyristors for process control.

Section I			
Ch. No.	**Contents**	**Hours**	**Marks**
1.	**Thyristors :** 1.1 SCR-Construction, principle of operation and V-I characteristics. 1.2 SCR- Two-transistor analogy. 1.3 Firing of SCR: Turn-on methods. 1.4 R and RC firing circuits. 1.5 Turn-off methods. 1.6 Ratings & specifications. 1.7 Protection schemes-Snubber circuit. 1.8 Application such as battery charger: basic concept.	**10**	**12**
2.	**Diac and Triac :** 2.1 Diac- Construction, principle of operation and V-I characteristics. 2.2 Triac- Construction, principle of operation and V-I characteristics. 2.3 Triac triggering modes. 2.4 UJT: Basic operation , circuit operation, V-I characteristic. 2.5 UJT relaxation oscillator. 2.6 UJT as an SCR triggering device.	**08**	**10**
3.	**Phase Controlled Converters:** 3.1 Single phase half-wave, full wave converters-Centre-tapped and bridge type-basic theory, waveforms, circuits with resistive(R) & inductive (R-L) loads. 3.2 Effect of Free Wheeling Diode (FWD). 3.3 Operation of three phase bridge converter.	**08**	**10**
4.	**Regulators and SMPS:** 4.1 Adjustable voltage regulators a) Connection diagram b) Standard package type c) Typical connection diagram d) Output equation e) IC LM 317, 723 f) Ratings g) Application 4.2 Basic concept of switching regulators: Theory of UPS and SMPS Block Diagram., applications.	**06**	**08**

Section II			
Ch. No.	**Contents**	**Hours**	**Marks**
5	**Power MOSFETS:** 5.1 N- Channel enhancement Power MOSFET: Basic structure, circuit diagram, working, output (V-I) characteristics, transfer characteristic and, applications. 5.2 IGBT : Insulated Gate Bipolar Transistor : Basic structure, circuit diagram, working, output (V-I) characteristics, transfer characteristic and, applications.	**10**	**12**
6	**Inverters :** 6.1 Inverters- definition, classification. 6.2 Circuit diagrams, operation, characteristics of series & parallel single phase inverters. 6.3 Basic theory of three phase inverter. 6.4 Cycloconverter. 6.5 Feed –forward Inverter	**06**	**08**
7	**Choppers :** 7.1 Choppers- definition, classification. 7.2 Basic chopper operation. 7.3 Chopper control Techniques. 7.4 Chopper circuits. 7.5 Ac choppers. 7.6 Applications.	**06**	**08**
8	**Applications :** 8.1 Triac based temperature control 8.2 Phase control using triac 8.3 Power converter control 8.4 Liquid level control using thyristor. 8.5 Opto- isolated solid state relay 8.6 Triac based control for actuation of valves.	**10**	**12**

List of Practicals (Any Eight) **:**

1. To plot the characteristics of SCR.
   (Observe terminals Configuration. Measure. Breakdown voltage, V-I characteristics, latching & holding current)
2. To plot the characteristics of Diac.
   (Observe terminals, V-I characteristics, Holding and latching currents.)
3. To plot the characteristics of Traic .
   (Observe terminal, V-I characteristics, Holding and latching currents.)
4. To measure the phase angle by varying the resistance for RC triggering Circuit.
5. UJT : a) To plot the V-I characteristic of UJT .
   b) To observe the waveforms of UJT relaxation oscillator.
6. To observe/plot the characteristics of single phase full- wave controlled rectifier.
7. To observe the variation of intensity by changing the firing angle for Light dimmer using triac.
8. To observe the functioning and measure the output of UPS/SMPS.
9. To measure the output of IC 723 ,Voltage regulator : High level, Low level Regulator.
10. Plot/Observe the Voltage & current waveforms with resistive load of single phase invertor.
11. To observe the output of DC choppers.
    a)To observe and plot the voltage in step up/ step down chopper
    b) To observe And plot the voltage in step up chopper with R load, RL load
12. To test & observe the output for solid state relay.
13. To test and observe battery charger using SCR.
14. To construct & test the 0.5A current source using regulator IC 7805.

Reference Books:

Sr. No.	**Name of the Book**	**Author**	**Publisher**	**Year of Publisher**
1	Thyristors : Theory & applications	**R. K. Sungandhi**	Willey	1993/II Edition
2	Thristors & their applications	**M. Ramamoorty.**	Eastwest	1999
3	SCR manual	**A.P.Connolly, R.W.Fox**	General Electric	6th Edition
4	Industrial & Power Electronics	**H. C. Rai**	IInd Edition, Galgotia Publications Pvt.Ltd.	1998
5	Power Electronics	**Khanchandani K.**	Tata McGraw Hill	2006
6	Industrial Electronics & control	**Bhattacharya**	TTI Chandigarh	1998

Programme Code: **IS**									
Course Code: **IS 11 302**			Course Title: **Control System Components**						
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
4	**--**	**2**	**6**	**80**	**20**	**50***	**--**	**--**	**150**

Note:

1) PR/OR marks with (*) indicates an assessment by Internal and External examiners, while PR/OR marks without (*) indicates an assessment by Internal examiner only.
2) TW marks by Progressive Assessment**.**
3) Theory paper duration is 03 Hrs. and term test duration is 01 Hr.
4) Theory Paper assessment by Internal and External examiners.

Rationale:

This subject is introduced with the view that the that the students will get familiar with the operation of various systems such as pneumatic , hydraulic , and electrical and their basic components. This will help to understand the operation of different types of final control elements. The knowledge of this subject is necessary to design and implement an effective process control systems.

Objectives: Students will able to

1. Know the components of pneumatic and hydraulic systems.
2. Understand the operation of various DCVs.
3. Distinguish between compressors and pumps.
4. Implement pneumatic and hydraulic circuits.
5. Understand the operation I to P and P to I converters.
6. Construction and operation of process control valves.
7. Select and size control valves for particular service.
8. Select appropriate Input and output hardware for either for PLC or Relay based controls.

Section I			
Ch. No.	**Contents**	**Hours**	**Marks**
1.	**Pneumatic System Components:** 1.1 Pneumatic system block diagram. 1.2 Air compressors. 1.3 Pressure regulators cum filters 1.4 Directional control valves: basic types and special types such as pilot−operated valves, non-return valves, flow control valves, sequence valves, and time delay valves. 1.5 ISO symbols of pneumatic system components. 1.6 Linear actuators: single-acting, double-acting, and special types of double-acting cylinders. 1.7 Rotary actuators-air motors. 1.8 Development of single actuator circuits.	10	12
2.	**Process Control Pneumatics:** 2.1 Flapper-nozzle system. 2.2 Volume boosters. 2.3 Air relays. 2.4 Converters: Pneumatic to Electrical and Electrical to Pneumatic converters. 2.5 Pneumatic transmitters and controllers. 2.6 Pneumatic logic gates.	06	08
3.	**Hydraulic System Components:** 3.1 Hydraulic system block diagram. 3.2 Hydraulic pumps. 3.3 Pressure regulation method, 3.4 Loading valves. 3.5 Hydraulic valves and actuators. 3.6 Speed control circuits for hydraulic actuators.	06	08
4.	**Electrical Control System Components:** 4.1 Switches: Toggle switches, push buttons, selector switch, DIP switch, rotary switch, thumbwheel switch, drum switch, limit switches-contact and non contact type. 4.2 Electromechanical devices: - Control Relays - Electro-mechanical relay, Reed relay, Solid state - relays, and Interposing relays. - Motor starters. - Auxiliary contacts. - Overload relays. 4.3 Time delay relays. 4.4 Over-current protection: fuses and breakers. 4.5 Lights: Indicator (pilot) lights and push to test Indicator (pilot) Lights (Construction, symbolic representation, working, applications and specifications.) 4.6 Selection and comparison of pneumatic, hydraulic and electric systems.	10	12

Section II			
Ch. No.	**Contents**	**Hours**	**Marks**
5.	**Process Control Valves:** 5.1 Control valve: Definition and classification. 5.2 Control valve terminology. 5.3 Control valve types: 5.3.1 Globe valves- Single-seated, double-seated, cage-guided, angle, split body valves and three-way globe valves. 5.3.2 Ball, Needle, Butterfly, Diaphragm, Pinch, Gate, Solenoid, Smart control valves. (Constructional diagram, ISA symbol, working, advantages, disadvantages and applications of above valve types.) 5.3 Control valve/flow characteristics: a) inherent and b) installed. 5.4 Materials of construction of different parts of control valve. 5.6 Control valve parameters: Control valve capacity (Cv), valve rangeability, turn-down, valve size and valve gain. 5.7 Control valve sizing procedure for simple liquid service-water. 5.8 Control valve problems: Cavitation, flashing and noise.	14	16
6.	**Control Valve Actuators and Positioners:** 6.1 Control Valve Actuators : 6.1.1 Pneumatic- spring diaphragm type and piston type. 6.1.2 Electrical-solenoid type and electric motor/gear type. 6.1.3 Electro-hydraulic. 6.1.4 Digital actuators. 6.2 Valve positioners: Necessity, types-motion balance and force balance, and effect on performance of control valve. 6.3 Selection criteria of control valves. 6.5 Specifications and installation of control valves. 6.6 Applications of control valves.	06	08
7.	**Auxiliary Process Control Components:** 7.1 Alarm annunciators. 7.2 Square root extractor. 7.3 Feeder and dampers. 7.4 Temperature, flow, level, and pressure Limit Switches. 7.5 Relief Valves, safety valves and rupture disk. (Construction, symbolic representation, working, applications and specifications.)	08	10
8.	**Electric Final Control Elements:** 8.1 Electric motors- a.c. and d.c. servomotors. 8.2 Stepper motors. 8.3 Synchros: transmitter and receiver and applications of Synchros as an error detector. 8.4 Amplidyne (Construction, working principle , applications and specifications.)	04	06

List of Practicals (Any eight):

1. Implementation and testing of Pneumatic circuits for single-acting and double acting cylinders. (Any two circuits for each)
2. Implementation and testing of Hydraulic circuits for single-acting and double acting cylinders. (Any two circuits for each)
3. To find the sensitivity of pressure to current converter.
4. To find the sensitivity of current to pressure converter.
5. To draw and identify the parts of cut-view section of single-seated globe valve.
6. To observe the construction of different valves. (Globe, ball, gate and butterfly valves).
7. To find switching time of temperature switch.
8. To find the switching time of pressure switch.
9. To observe the operation of any two type of control valve actuators.
10. To draw the input-output characteristics potentiometer as an error detector .
11. To observe the forward/reserve direction movement of stepper motor
12. To plot the characteristics (angular displacement Vs winding voltages) of synchro transmitter
13. To plot the graph of angular displacement of rotor of sychro transmitter and angular displacement of rotor of synchro receiver (follow up system.)
14. To plot the speed- torque characteristics of AC servomotors.
15. To test and observe the operation of SSR and electo-mechanical relays.

Reference Books:

1. Pneumatics and Hydraulics by Andrew Parr.
2. Pneumatics, Festo Didactic
3. Hydraulics, Festo Didactic
4. Control Valve Handbook by Driskell (ISA H Book)
5. Valve Handbook by Philip L. Skousen The McGraw –Hill 2004
6. Control System Engineering by Nagrath I. J. , M. Gopal John Wiley & Sons 2nd edition 1982 Delhi
7. Industrial Electronics, Petruzella, McGraw-Hill
8. Process Instruments and Controls Handbook, Douglas M. Considine, McGraw-Hill.

Programme Code: **IS**									
Course Code: **IS 11 306**			Course Title: **Microprocessor Techniques**						
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
4	**--**	**2**	**6**	**80**	**20**	**50***	**--**	**--**	**150**

Note:

1) PR/OR marks with (*) indicates an assessment by Internal and External examiners, while PR/OR marks without (*) indicates an assessment by Internal examiner only.
2) TW marks by Progressive Assessment**.**
3) Theory paper duration is 03 Hrs. and term test duration is 01 Hr.
4) Theory Paper assessment by Internal and External examiners.

Rationale:

Instrumentation diploma holders are expected to work now days in high-tech environments involving Microprocessors, PLC's and Computers. Fundamental knowledge of microprocessors will help them to cope up with more advanced courses related to microprocessors. This course is intended to make students familiar with the concept of 8 bit microprocessor which is now a day commonly used in process industries.

Objectives: - Students will able to

1. Know the concept of microprocessor.
2. Understand the architecture of the 8085 microprocessor.
3. Draw the internal blocks of the 8085 microprocessor.
4. Explain the working of various blocks inside the 8085 microprocessor.
5. Understand the instruction set of 8085 microprocessor.
6. Use the single board 8085 microcomputer Kit.
7. Understand timing diagrams for the 8085microprocessor.
8. Understand the instruction and machine cycles of the 8085 microprocessor.
9. Explain the function of peripheral devices for various applications.
10. Use the peripheral devices for various applications.
11. Explain the features of advanced microprocessor.
12. Write assembly level language program for 8085 microprocessor .

Section I			
Ch. No.	**Contents**	**Hours**	**Marks**
1.	**Review of SSI & MSI devices** 1.1 Tri-state buffers (unidirectional & bi-directional such as 74LS244,74LS245 & 8286) 1.2 Decoders such as 74LS138, Encoders such as 74LS148, 1.3 Latches such as 74LS373 & 8282 (Only logic diagrams of above IC's are expected)	05	06
2.	**Architecture of 8085** ***2.1 The 8085 Architecture, functions of all blocks, 8085 Bus structure.*** ***2.2 Pin configuration of IC 8085, Function of each pin.*** ***2.3 Features of 8085.*** ***2.4 Applications of microprocessors.***	06	08
3.	**Instruction set for 8085 Microprocessor** ***3.1 Instruction format: one, two, three byte instructions.*** 3.2 Data transfer, arithmetic, logical, branching, stack related and machine control group of instructions, 3.3 Addressing mode (Register addressing, Immediate, direct addressing, register indirect addressing Implicit addressing) of each of the instruction should be explained. Similarly number of bytes required and flags affected should be explained**.**	08	08
4.	**Software Development:** ***4.1 Developing algorithm and flowchart. Writing & debugging simple assembly language programs.*** ***4.2 Stack, Subroutine and its importance.*** ***4.3 Counter and delay program for required time Using a register/ register pair.***	13	18

Section II			
Ch. No.	**Contents**	**Hours**	**Marks**
5.	**Timing Diagrams** ***5.1 Fetch, code and execute operation*** ***5.2 Representation of signal in Timing Diagram: Clock signal, Single line, Multiple line, Multiple line with high impedance signal.*** ***5.3 Timing diagrams:*** ***Machine cycle, T-state Instruction cycle Opcode fetch*** ***Memory and I/O read cycle Memory and I/O write cycle*** ***Wait state*** ***Interrupt acknowledge cycle*** ***5.4 Timing diagram for instructions:*** ***MOV R1, R2 ADD R RAL HLT*** ***EI MOV M, R SUB M ADI data*** ***LXI rp, data POP rp JZ add LDA add*** ***STA add LHLD add SHLD add CALL add***	05	06
6.	**Interrupt Structure of 8085** ***6.1 Types of Interrupts*** ***6.2 8085 Interrupt Structure: Hardware interrupts, software interrupts*** ***6.3 Comparison between hardware and software interrupts,*** ***6.4 Interrupt Logic Control Instructions: Enable Interrupt, Disable Interrupt, Set Interrupt Mask, Read Interrupt Mask.*** ***6.5 Interrupt priority structure, Interrupt Systems*** ***Use of SOD and SID pins.***	05	06
7.	**Memory and Input Output Interfacing** 7.1 ***Memory classification: RAM Static, Dynamic memory, ROM, PROM, EPROM, EEPROM, Flash memory. Reading and writing into memory*** 7.2 Need of interfacing 7.3 Block diagram of interfacing read/write memory & EPROM using decoder. 7.4 Memory mapped and I/O mapped techniques: Addressing scheme , logical diagram 7.5 Interfacing seven segment displays, Software and Hardware .approach.	12	16
8.	**Advanced Microprocessors** 8086: Features, Functional block diagram. Role of BIU and EU, various segment resisters, computation of physical address. Flag register of	10	12

	8086 , comparison between 8085/8086/8088 .		

LIST OF PRACTICALS (Any eight)**:**

1. To draw the layout of single board 8085 microprocessor/ micro computer and Identification of each function block & IC's realizing those functional blocks.

2. Simple assembly language programs to illustrate use of the instruction of each of the data transfer, arithmetic, logical, branch control & I/O & machine control group instructions (Programs should be simple, of few lines should emphasis use of the instructions. All major instructions of each group should possibly be covered. Flag register contents should be checked after execution of programs to illustrate flags affected by the execution of particular instruction.

3. At least **six** of following programs :-
   a) Program for data transfer.
   b) Program for addition of N- Numbers (8 bit & 16 bit).
   c) Find two's complement of a given number.
   d) Count the number of ones in a given number
   e) Mask the upper/lower nibble of a given 8-bit number
   f) Addition of two BCD numbers
   g) Calculate the sum of series of numbers
   h) Finding the smallest number of the given array of the numbers.
   i) Finding the largest number of the given array of the numbers.
   j) Arranging the given numbers of the array in an ascending order.
   k) Arranging the given numbers of the array in descending order.

Reference Books:

Sr. No.	Name of Book	Name of Author	Edition	Publication
1.	Fundamentals of Microprocessors and Microcomputers	Dr B. Ram	First,second,	Dhanpat Rai pvt Ltd
2.	Microprocessors, Architecture, Programming & Applications with the 8085/8080A	R.S. Gaonkar.	First,second,	Penaram International Pvt Ltd
3.	Introduction to Microprocessor Tata McGraw Hill	A. P. Mathur	First,	Tata McGraw Hill
4.	Microprocessor Programming& interfacing(Intel 8085&8086)	H.khan	First,	Everest publishing house

Programme Code: **IS**									
Course Code: **IS 11 311**			Course Title: **Professional Practice**						
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
--	**2**	**--**	**2**	**--**	**--**	**--**	**--**	**50**	**50**

Note:

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2) TW marks by Progressive Assessment**.**
3) Theory paper duration is 03 Hrs. and term test duration is 01 Hr.
4) Theory Paper assessment by Internal and External examiners.

Rationale:

Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests. While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts. The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Objectives: - Students will able to

1. Know the role of Instrumentation involved in the Industry.
2. Acquire information from different sources.
3. Prepare notes for given technical topic.
4. Present a seminar on given topic.
5. Interact with peers to share thoughts.
6. Prepare a report on industrial visit, expert lecture and seminars.

Section I		
Ch. No.	**Contents**	**Hours**
1.	**Industrial Visits** Structured industrial visits be arranged and **report** of the same should be submitted by the individual student, to form a part of the term work. **TWO** industrial visits may be arranged in the following areas / industries : i) Chemical Plant ii) Process Industry iii) Power Plant iv) Building Automation v) Biomedical Instrument	08
2.	**Lectures by Professional / Industrial Expert be organized from** ANY THREE **of the following areas :** i) Industrial Automation ii) Role of Instrumentation Engineer iii) Selection of control Valve iv) Calibration of Instruments v) Mounting of instruments vi) Trouble shooting of instruments vii) Sensors & Transducers viii) Process control ix) Carrier options for instrumentation Engineer.	08

Section II		
Ch. No.	**Contents**	**Hours**
3.	**Individual Assignments** : **Any two** from the list suggested a) Process sequence of any batch process. b) Write specifications for any two transducers. c) Selection criteria for any 2 transducers. d) Preparing models using development of surfaces. e) Assignments on control valve types, Diagram, application f) Assignment on installation of DP transmitter.	08
4.	**Personality development:** a) Conduct aptitude , general knowledge test , IQ test b) Resume writing c) Interview techniques	08