EVEN 2025-26 **IS19301/ IS19R301**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) (Sandwich Pattern)**
Course Title : **Process Control System**

2:30 Hours / 60 marks Enrolment No. | | | | | | | | | | | |

Instructions:
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define process. List its any two examples. **[CO-1, L-R]**
b. State the importance of process control system (any two points.) **[CO-1, L-R]**
c. Name any two methods used for tuning of PID controller. **[CO-2, L-R]**
d. List any two disadvantages of ON- OFF controller. **[CO-2, L-U]**
e. List any two advantages of feed forward control system. **[CO-3, L-R]**
f. Draw ISA symbol for i) Electrical signal ii) Pneumatic signal. **[CO-4, L-R]**
g. Draw ISA symbol for i) Panel mounted instrument ii) Field mounted instrument. **[CO-4, L-R]**
h. Define project. List any two types of project. **[CO-4, L-U]**
i. Define hazardous area. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Describe the following term with respect to process control. i) Controlled variables ii) Manipulated variables. **[CO-1, L-U]**

b. Name different ratio control system. Explain any one of them with suitable diagram. **[CO-3, L-U]**

c. Draw a temperature control loop using standard ISA symbol. **[CO-4, L-A]**

d. Explain the role of instrumentation engineer in setting up a project. **[CO-4, L-U]**

Q.3 Attempt any THREE **12 Marks**

a. Explain split range control system with suitable industrial example. **[CO-3, L-A]**

b. Prepare a sample instrument index sheet and discuss its importance in project documentation. **[CO-4, L-A]**

c. Draw a hook up diagram for suitable process and prepare bill of material for the same. **[CO-4, L-A]**

d. Classify hazardous area as per NEC standard. **[CO-5, L-A]**

Q. 4 Attempt any FOUR **12 Marks**

a. State the role of following in process control system.
i) Sensor / Transducer ii) Controller iii) Final control element. **[CO-1, L-U]**

b. List the control modes and selection criteria for different process. (any three) **[CO-2, L-A]**

c. Describe the proportional control mode in brief. **[CO-2, L-U]**

d. Explain loop checking procedure in brief. **[CO-4, L-U]**

e. Explain any one technique used to reduce the danger of explosion hazard. **[CO-5, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Draw a neat diagram of electronic PID controller and explain it in brief. **[CO-2, L-A]**

b. Draw a neat labelled block diagram of Cascade control system and explain it. List its any two application. **[CO-3, L-A]**

c. Explain Piping and Instrumentation diagram with suitable drawing. **[CO-4, L-A]**

****End****

EVEN 2025-26

IS19R206/IS19206

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) (Sandwich Pattern)**
Course Title : **Basics of Electronics**

2:30 Hours/ 60 marks Enrolment No.

Instructions:
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO :COURSE OUTCOMES, L: LEVELS

Q.1 Attempt any SIX **12 Marks**

a. List any two semiconductor materials. **[CO-1, L-R]**
b. State the working principle of P-N junction diode. **[CO-1, L-R]**
c. Define ripple factor. **[CO-2, L-R]**
d. Enlist types transistors. (any two) **[CO-3, L-R]**
e. State the operating point of transistor. **[CO-3, L-R]**
f. State any two applications of FET. **[CO-4, L-R]**
g. List types of MOSFET. **[CO-4, L-R]**
h. Enlist any two types of filters. **[CO-5, L-R]**
i. State the application of zener diode. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Explain the construction of P-N junction diode with suitable diagram. **[CO-1, L-U]**
b. Describe the working of UJT with proper circuit diagram. **[CO-3, L-U]**
c. Compare MOSFET & JFET. (any four points) **[CO-4, L-A]**
d. Explain transistorized series regulator working with proper circuit diagram. **[CO-5, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Describe working of half wave rectifier with circuit diagram. Also draw input and output waveform. **[CO-2, L-U]**
b. Explain working of voltage divider bias with suitable circuit diagram. **[CO-3, L-U]**
c. Differentiate in between FET & BJT. (any four points) **[CO-4, L-A]**
d. Describe the working of transistorized shunt regulator with circuit diagram. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Explain the following terms (i) Peak Inverse Voltage (PIV) (ii) Transformer Utilization Factor (TUF). **[CO-2, L-U]**
b. Describe input and output characteristics of common emitter configuration with graph. **[CO-3, L-A]**
c. Describe working of fixed bias with circuit diagram. **[CO-4, L-U]**

d. Explain depletion MOSFET in brief with suitable diagram. [CO-4, L-U]
e. Compare line regulation and load regulation. (any three points) [CO-5, L-A]

Q. 5 Attempt any TWO **12 Marks**

a. Describe V-I characteristics of P-N junction diode with neat diagram. [CO-1, L-U]
b. Describe positive, negative and biased clipper circuit along with its input and output waveforms. [CO-2, L-A]
c. Distinguish between common base, common emitter and common collector configuration in transistor. (any six points) [CO-3, L-A]

****End****

EVEN 2025-26 TS19R210/EE19211

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : Instrumentation
Course Title : Electrical Machines

2:30 Hours / 60 marks Enrolment No. | | | | | | | | | | |

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. State working principle of transformer. **[CO-1, L-R]**
b. Define efficiency and regulation of transformer. **[CO-2, L-U]**
c. State the types of DC motor. **[CO-2, L-U]**
d. State necessity of starter for DC motor. **[CO-1,2,3, L-U]**
e. State advantages and disadvantages of three phase induction motor. **[CO-1,2,3, L-R]**
f. State how to reverse direction of rotation of three phase induction motor. **[CO-1,2,3, L-U]**
g. Draw schematic diagram capacitor start induction motors. **[CO-1,2, L-U]**
h. State application of AC servo motor. **[CO-1,2, L-A]**
i. State classification of electric drive. **[CO-3,4, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. State factors governing selection of motor. **[CO-3,4, L-U]**
b. Draw and explain principle of operation of slipper motor with diagram. **[CO-1,2, L-U]**
c. Draw constructional details of 3 phase squirrel cage induction motor and explain it. **[CO-1,2,3, L-U]**
d. Explain speed control of DC shunt motor using armature voltage control method. **[CO-1,2,3, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. State types of instrument transformer and state use of it. **[CO-1,2, L-R/U]**
b. A 3 phase induction motor is wound for 4 poles and is supplied from $50H_2$ system calculate i) Synchronous speed ii) Slip when rotor runs at 600rpm. **[CO-1,2,3, L-A]**
c. Draw and explain principle of operation of DC servo motor with application. **[CO-1,2, L-U/A]**
d. Explain rheo static braking applied to 3 phase induction motor. **[CO-3,4, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Define individual drive and group drive. **[CO-3,4 L-U]**

b. Suggest motor for following application i) Sewing machine ii) Refrigerator iii)Robotics iv) Air conditioners v) Machine tools vi) Electric vehicle. **[CO-1,2, L-A]**

c. Define synchronous speed and percentage slip. **[CO-1,2,3, L-R]**

d. State function of following parts of DC motor i) Pole shoes ii) Commutator iii) Armature core iv) Field winding. **[CO-2, L-U]**

e. State advantages and disadvantages of auto transformer. **[CO-1,2, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Explain Electrical, speed armature current and mechanical characteristic of DC shunt motor with diagram. **[CO-1,2,3, L-U]**

b. State speed control of three phase I.M. Explain any one with diagram. **[CO-1,2,3, L-U]**

c. Explain Brushless dc motor with diagram and state application of it. **[CO-1,2, L-U]**

****End****

EVEN 2025-26

EE19206/EE19R206

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E&C) (Sandwich Pattern)**
Course Title : **Fundamental of Electrical Engineering**

2:30 Hours / 60 marks Enrolment No.

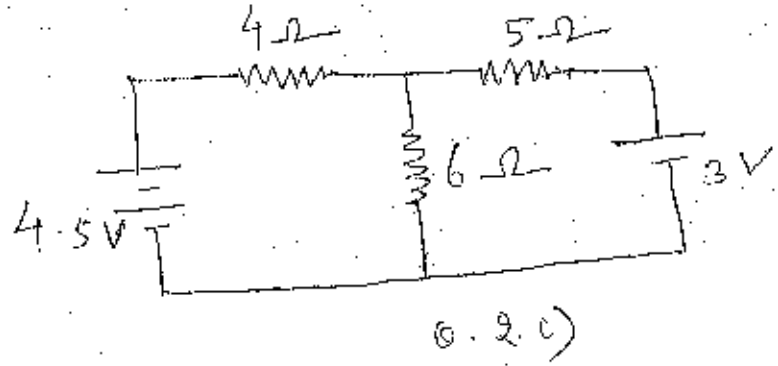
Instructions:
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary.
6. CO- COURSE OUTCOMES, L-LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define electric potential and potential difference. **[CO-1, L-R]**
b. State factors on which resistance depends. **[CO-1, L-U]**
c. State any two main characteristics of dc parallel circuit. **[CO-2, L-U]**
d. Define unilateral circuit and bilateral circuit. **[CO-2, L-R]**
e. State methods for network analysis. **[CO-3, L-R]**
f. State maximum power transfer theorem. **[CO-3, L-U]**
g. Draw phasor diagram of ac circuits through pure capacitance. **[CO-4, L-U]**
h. Define balanced load and unbalanced load. **[CO-5, L-R]**
i. State types of wiring for domestic installation. **[CO-6, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Electrical installation is used in a house in the following manner i) Lamps 40W each, 5 nos, 6 hours a day ii) Fans 60W each 2 nos, 10 hours a day. Calculate total electrical energy for 30 days. **[CO-1, L-A]**
b. Compare series circuit with parallel circuit (any four). **[CO-2, L-U]**
c. Using Thevenin's theorem, find the current in 6Ω resistor in the following figure.



(6.2 C)

[CO-3, L-A]

d. Define the following terms i) Active power ii) Reactive power iii) Apparent power iv) Power factor. **[CO-4, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Explain Norton's theorem with equivalent circuit diagram. Write down Norton current equation. **[CO-3, L-U]**

b. A pure inductance of 318mh is connected in series with a pure resistance of 75Ω. The circuit is supplied from 50Hz source and the voltage across 75Ω resistor is found to be 150V calculate the supply voltage and phase angel. **[CO-4, L-A]**

c. State advantages of three phase supply over single phase supply (any four). **[CO-5, L-U]**

d. Explain concept of lighting circuit and power circuit. **[CO-6, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Define fuse. State importance of fuse. **[CO-6, L-U]**

b. Compare star connected system with delta connected system (any three). **[CO-5, L-U]**

c. State advantages of AC supply over DC supply (any three). **[CO-4, L-U]**

d. Explain Kirchhoff's voltage law with diagram. **[CO-2, L-U]**

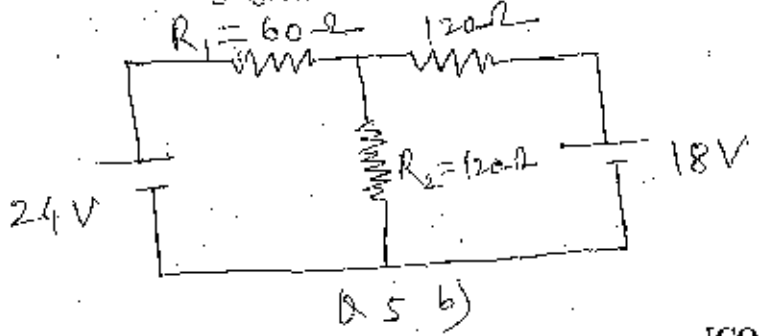
e. Explain measurement of voltage, current and power with diagram. **[CO-1, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. i) Two resistor of 4Ω and 6Ω are connected in parallel. If the total current is 30A. Find current through each resistor. **[CO-2, L-A]**

ii)Draw staircase wiring and explain it. **[CO-6, L-U]**

b. Use the superposition theorem to find the current in R_1=60Ω in the circuit shown in the following figure.



[CO-3, L-A]

c. Three similar coils each having a resistance of 5Ω and an inductance of 0.02H are connected in delta to a 440V, 3-phase, 50Hz supply. Calculate line current and total power absorbed. **[CO-5, L-A]**

****End****

EVEN 2025-26 **IS19R201**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) (Sandwich Pattern)**
Course Title : **Principles of Measurement**

2:30 Hours/ 60 marks Enrolment No.

Instructions:
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define measurement. **[CO-1, L-R]**
b. Enlist different types of metrology. **[CO-1, L-R]**
c. Define transducer. **[CO-2, L-R]**
d. State Pascal's law of pressure measurement. **[CO-3, L-U]**
e. Give any two applications of barometer. **[CO-3, L-A]**
f. List different types of fluid flow. **[CO-3, L-R]**
g. State Bernoulli's equation for ideal and real fluids. **[CO-3, L-U]**
h. Give any four applications of MEMS sensors. **[CO-4, L-A]**
i. List elements used in MEMS sensor. **[CO-4, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Explain with neat block diagram of instrumentation system. **[CO-1, L-U]**
b. Explain principle operation of resistive transducer. **[CO-2, L-U]**
c. Explain with neat diagram principle of operation of U-tube manometer. **[CO-3, L-U]**
d. Give difference between heat and temperature. **[CO-3, L-A]**

Q. 3 Attempt any THREE **12 Marks**

a. Distinguish between photo emissive and photo conductive sensor. **[CO-2, L-A]**
b. Explain with neat diagram principle operation of rotameter. **[CO-3, L-U]**
c. Explain principle operation of bimetallic strip thermometer. **[CO-3, L-U]**
d. Explain working principle of IoT sensor. **[CO-4, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Distinguish between active and passive transducer. **[CO-1, L-A]**
b. State the principle operation of ultrasonic transducer. **[CO-2, L-U]**
c. List different types of pressure and draw neat labeled diagram of C-type bourdon tube. **[CO-3, L-A]**
d. Draw different types of orifice meter plate and label it. **[CO-3, L-A]**
e. List any two applications of analytical sensor with its working principle. **[CO-4, L-A]**

Q. 5 Attempt any TWO **12 Marks**

a. Enlist different static characteristics of instrument (any 4) and describe briefly sources of errors in measuring instruments. **[CO-1, L-R/A]**

b. Draw neat labeled diagram of venturi-meter and explain its principle of operation. Also write it's any two applications. **[CO-3, L-A]**

c. Define seeback effect. List different units of temperature measurement and write equation for convert $50^{o}C$ temperature into Fahrenheit (^{o}F). **[CO-3, L-R/A]**

****End****

EVEN 2025-26 **IS19R402/IS19402**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) (Sandwich Pattern)**
Course Title : **Power Plant Instrumentation**

2:30 Hours / 60 marks Enrolment No.

Instructions:
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO- COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Give classification of power plants. **[CO-1, L-R]**
b. Enlist any 4 important factor to select the site for any type of power plant. **[CO-1, L-R]**
c. List different types of flow circuits of thermal power plant. **[CO-2, L-U]**
d. Draw the block diagram of thermal power plant. **[CO-2, L-U]**
e. State significance of ultimate analysis of coal. **[CO-2, L-A]**
f. Give classification of hydro electric power plant. **[CO-3, L-R]**
g. Give any four advantages of solar power plant. **[CO-5, L-R]**
h. State any four renewable energy sources. **[CO-5, L-U]**
i. Give any four advantages of wind energy. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Explain briefly need of electrical power generation. **[CO-1, L-U]**
b. Explain briefly role of instrumentation in thermal power plant. **[CO-2, L-U]**
c. Explain role of surge tank in load variation of hydro-electric power plant with neat diagram. **[CO-3, L-U]**
d. Explain with neat diagram pressurized water reactor (PWR). **[CO-4, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Distinguish between conventional and non-conventional energy source of power plant. **[CO-1, L-A]**
b. State main component of hydro-electric power plant. **[CO-3, L-U]**
c. Explain in detail concept of energy generation from nuclear fission in nuclear power plant. **[CO-4, L-U]**
d. Give comparision between tidal energy and wind energy. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. State the working principle of electric power generation. **[CO-1, L-U]**
b. State any three features of high pressure boiler. **[CO-2, L-U]**
c. State the factors to select the site of hydro-electric power plant. (any 3) **[CO-3, L-A]**
d. Draw neat labelled diagram heavy water cooled type reactor plant. **[CO-4, L-A]**
e. Enlist any three applications of wind energy. **[CO-5, L-R]**

Q. 5 Attempt any TWO **12 Marks**

a. List different types of fire detector used in thermal power plant and explain in details photo-electric type detector with neat schematic. **[CO-2, L-A]**

b. Draw the diagram of storage type hydro-electric power plant & describe function of each component used. **[CO-3, L-A]**

c. Draw neat schematic of nuclear power plant and explain its operation. Also name two fuels used in nuclear power plant. **[CO-4, L-A]**

****End****

EVEN 2025-26

IS19306/IS19R306

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E&C) (Sandwich Pattern)**
Course Title : **Unit Operations & Instrumentation**

2:30 Hours / 60 marks Enrolment No:

Instructions:
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO-COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define unit operation. **[CO-1, L-R]**
b. Compare unit operation and unit process (any two points). **[CO-1, L-A]**
c. Draw flow sheet symbol of heat exchanger. **[CO-2, L-R]**
d. Define distillation. **[CO-3, L-R]**
e. Draw flow sheet symbol of evaporator. **[CO-4, L-R]**
f. Draw flow sheet symbol of dryer. **[CO-4, L-R]**
g. List any two factors affecting the rate of drying. **[CO-4, L-A]**
h. Draw flow sheet symbol of crystallizer. **[CO-5, L-R]**
i. Define magma. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Describe reversible and irreversible process with suitable example. **[CO-1, L-U]**
b. Draw a neat diagram of fire tube boiler and explain its operation. **[CO-2, L-U]**
c. Explain pressure control scheme in distillation column. **[CO-3, L-A]**
d. State the importance of crystal size in crystallizer. **[CO-5, L-A]**

Q. 3 Attempt any THREE **12 Marks**

a. Compare batch and continuous process (any four points). **[CO-1, L-A]**
b. Classify heat exchangers. **[CO-2, L-A]**
c. List any four applications of distillation process. **[CO-3, L-A]**
d. Draw a neat labeled diagram of continuous crystallizer. List its any two advantages. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Draw process flow diagram of oil refinery with necessary labellings. **[CO-1, L-A]**
b. List any three interlocks in boiler. **[CO-2, L-A]**
c. Explain shrink and swell phenomenon in boiler. **[CO-2, L-A]**
d. Draw a neat labeled diagram of tray dryer and explain its operation. **[CO-4, L-U]**

e. Explain feed forward control scheme in evaporator with neat diagram. [CO-4, L-A]

Q. 5 Attempt any TWO **12 Marks**

a. Draw a neat labeled diagram of shell and tube type of heat exchanger and explain its operation in details. [CO-2, L-U]

b. Draw equipment set up of flash distillation and explain its operation. [CO-3, L-U]

c. Draw a neat labeled diagram of climbing film evaporator and explain its operation. [CO-4, L-U]

****End****

EVEN 2025-26 **IS19R304/IS19304**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) Sandwich Pattern**
Course Title : **Instrumentation Circuits Design**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. List any four applications of op-amp. **[CO-1, L-R]**
b. Define virtual ground concept of op-amp. **[CO-1, L-R]**
c. Draw neat labeled circuit diagram of square wave generator. **[CO-2, L-U]**
d. List any four advantages of instrumentation amplifier. **[CO-3, L-R]**
e. State advantages of active filter over passive filter. **[CO-4, L-R]**
f. Draw frequency response of wide band pass filter. **[CO-4, L-U]**
g. State need of timer IC555. **[CO-5, L-R]**
h. Draw circuit diagram of frequency divider circuit using IC555 timer. **[CO-5, L-A]**
i. List any four applications of IC555 timer. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Explain with neat block diagram of op-amp. **[CO-1, L-U]**
b. Derive output equation of adder circuit using op-amp. **[CO-2, L-U]**
c. Draw neat circuit diagram of three op-amp instrumentation amplifier and write its output equation. **[CO-3, L-U]**
d. Describe briefly working of astable multivibrator using IC555 timer. Also write its T_{on} & T_{off} equation. **[CO-5, L-A]**

Q. 3 Attempt any THREE **12 Marks**

a. Explain with neat circuit diagram operation of sample & hold circuit using op-amp. **[CO-2, L-U]**
b. Draw pin diagram of IC LM324 and write its any four applications. **[CO-3, L-U]**
c. Draw circuit for low pass filter and explain with frequency response. **[CO-4, L-U]**
d. Draw the circuit diagram of monostable multivibrator with its output waveforms and output equation. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. State any three electrical characteristics of ideal op-amp. **[CO-1, L-U]**
b. Draw circuit diagram of non-inverting amplifier using op-amp. Write its output equation. **[CO-2, L-U]**

c. List any two applications of V to I converter with floating load. Draw its circuit diagram using op-amp. **[CO-2, L-R]**

d. Distinguish between band reject filter and band pass filter. (any three points) **[CO-4, L-A]**

e. State any two features of IC555 timer and draw its pin diagram. **[CO-5, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Draw and derive output equation of integrater circuit using op-amp. State need of practical integrater and draw input and output waveform. **[CO-2, L-A]**

b. Describe with neat circuit diagram signal conditioning circuit for RTD using instrumentation amplifier. **[CO-3, L-A]**

c. Define the following terms related to filter : **[CO-4, L-U]**

(i) Cut-off frequency
(ii) Q-factor
(iii) Bandwidth
(iv) Order of filter
(v) Pass band
(vi) Stop band

****END****

EVEN 2025-26 **IS19302/IS19R302**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E&C) (Sandwich Pattern)**
Course Title : **Maintenance of Instruments & Systems**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. State the need for instruments maintenance. **[CO-1, L-R]**
b. List any two maintenance tips for RTD/Thermocouple based temperature transmitter. **[CO-2, L-U]**
c. Name the elements of preventive maintenance (any four). **[CO-2, L-U]**
d. List the types of calibration standards. **[CO-3, L-R]**
e. State any two IS09000 requirements of calibration. **[CO-3, L-U]**
f. Name the basic methods of temperature calibration. **[CO-4, L-U]**
g. List any two temperature standards along with their temperature ranges. **[CO-4, L-R]**
h. State the need of flow meter calibration. **[CO-4, L-U]**
i. Draw 4-20 mA current loop of two wire temperature transmitter. **[CO-5, L-A]**

Q.2 Attempt any THREE **12 Marks**

a. Distinguish between corrective maintenance & preventive maintenance with one example of each. **[CO-1, L-U]**
b. Explain the role of instrument maintenance engineer (any four point). **[CO-2, L-U]**
c. Differentiate between individual instrument calibration and loop calibration (any four point). **[CO-3, L-A]**
d. Explain calibration of thermocouples using comparison method. **[CO-4, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Explain logical analysis trouble shooting technique. **[CO-1, L-U]**
b. Explain the safety practices followed in maintenance and troubleshooting of instruments. **[CO-2, L-A]**
c. Explain the volumetric type calibration method for liquid flowmeters (any one). **[CO-4, L-U]**
d. Explain preventive maintenance checklist of DCS. **[CO-5, L-A]**

Q. 4 Attempt any FOUR **12 Marks**

a. Discuss the troubleshooting guidelines of turbine flow transmitter (any three point). **[CO-2, L-A]**

b. Compare bench calibration and field calibration (any three point). **[CO-3, L-A]**

c. Define fixed point cell-tripple point of water and draw its diagram. **[CO-4, L-U]**

d. Draw calibration setup of air purge level indicator. **[CO-4, L-A]**

e. Write any three troubleshooting tips for automation & process control loops. **[CO-5, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Draw and explain the calibration procedure of pressure gauge using pneumatic or hydraulic dead weight tester (DWT). **[CO-4, L-A]**

b. Draw and explain the PVTt type calibration method for gas flow meters. **[CO-4, L-A]**

c. Discuss the preventive maintenance check list & troubleshooting for programmable logic controller (PLC). **[CO-5, L-A]**

****End****

EVEN 2025-26 IS19203/IS19R203

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering**
Course Title : **Industrial Measurement**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Draw neat labeled diagram of float type level indicator. **[CO3, L-R]**
b. Define displacement. State its units. **[CO1, L-R]**
c. Compare RVDT and LVDT (any two points) **[CO1, L-A]**
d. Enlist the types of pressure. **[CO2, L-R]**
e. State the application of elastic pressure transducer.(any two) **[CO2, L-R]**
f. State the formula for Reynold's number. Express each term with its unit. **[CO4, L-R]**
g. Enlist the types of flow. **[CO4, L-R]**
h. List any two types of orifice plates **[CO4, L-R]**
i. State the long form of Pt-100. State its application. **[CO5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Describe the working principle of bubbler type level measurement system. With the help of suitable diagram. **[CO3, L-U]**
b. Classify the types of displacement transducer. **[CO1, L-A]**
c. Describe with neat sketch working principle of Rotameter.**[CO4, L-U]**
d. Compare RTD and thermistor (any four points) **[CO5, L-A]**

Q. 3 Attempt any THREE **12 Marks**

a. Explain the Ultrasonic type level transducer with a suitable diagram. **[CO3, L-A]**
b. Explain with neat diagram, construction and working of Bimetallic strip thermometer. **[CO5, L-U]**
c. Explain the calibration of pressure guage using dead weight tester.**[CO2, L-U]**
d. Differentiate between orifice plate and venture tube w.r.t construction, pressure drop, shape and cost. **[CO4, L-A]**

Q. 4 Attempt any FOUR **12 Marks**

a. Discuss the selection criteria for level transducer (any three points) **[CO3, L-A]**
b. Describe the effect of temperature on strain guage measurement.**[CO1, L-U]**

c. Enlist the types of manometers and explain any one of them with suitable diagram. [CO2, L-U]
d. Give the classification of flow meters. [CO4, L-U]
e. Distinguish between Radiation type. And optical type pyrometer.(any three points) [CO5, L-A]

Q. 5 Attempt any TWO **12 Marks**

a. Draw neat labeled diagram of RTD and explain its working. State its any two application. [CO5, L-A]
b. Explain the working of LVDT with suitable diagram. And also state any tow application of it. [CO1, L-U]
c. Draw a neat labeled diagram of C-type bourdon tube and explain its working. State its any two disadvantages. [CO2, L-A]

****End****

EVEN 2025-26 IS19208 /IS19R208

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) Sandwich Pattern**
Course Title : **Applied Electronics**

2:30 Hours / 60 marks Enrolment No.

Instructions:
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. List types of voltage amplifier. **[CO-1, L-R]**
b. Define distortion. **[CO-1, L-R]**
c. State Barkhausen criteria. **[CO-2, L-R]**
d. Draw symbol of SCR. Also state its full form. **[CO-3, L-R]**
e. State the working principle of chopper. **[CO-4, L-R]**
f. List any two applications of thyristor. **[CO-5, L-R]**
g. State any two advantages of negative feedback in amplifier. **[CO-1, L-R]**
h. Enlist types of oscillators. **[CO-2, L-R]**
i. State working principle of DIAC. **[CO-3, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Explain with circuit diagram push pull power amplifier. **[CO-1, L-U]**
b. Describe operation of R-C phase shift oscillator with neat circuit diagram. **[CO-2, L-U]**
c. Compare single phase bridge inverter & 3ϕ phase bridge inverter (any four points) **[CO-4, L-A]**
d. Distinguish between DCSSR and ACSSR (any four points). **[CO-5, L-A]**

Q. 3 Attempt any THREE **12 Marks**

a. Compare voltage series feedback and current series feedback (any four points). **[CO-1, L-A]**
b. Explain the principle of operation of TRIAC and draw its V-I characteristics. **[CO-3, L-A]**
c. Explain single phase full wave controlled rectifier with circuit diagram. **[CO-4, L-U]**
d. Describe TRIAC based temperature control with circuit diagram. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Explain principle of operation of direct coupled amplifier with circuit diagram. **[CO-1, L-U]**
b. Describe operation of astable multivibrator with circuit diagram. **[CO-3, L-U]**
c. Describe in brief 'R' trigger method of turn-on of SCR. **[CO-1, L-U]**
d. Explain in short four quadrant chopper with circuit diagram. **[CO-4, L-U]**
e. Explain liquid level control using SCR with circuit diagram. **[CO-5, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Explain principle of operation of wein bridge oscillator with circuit diagram and waveform. **[CO-2, L-U]**

b. Describe principle of operation of SCR, also draw its V-I characteristics. **[CO-2, L-A]**

c. Explain 3-Phase full wave controlled rectifier with circuit diagram. **[CO-5, L-U]**

****END****

EVEN 2025-26 **IS23104**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E&C) (Sandwich Pattern)**
Course Title : **Industrial Measurements**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt **all** the questions.
2. Illustrate your answers with **neat sketches** wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full **marks** for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L-LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Enlist any two applications of potentiometer. **[CO-1, L-R]**
b. Define gauge factor with its equation. **[CO-1, L-R]**
c. List different types of electrical pressure transducer. **[CO-2, L-R]**
d. Draw a neat schematic of pirani guage & label it properly. **[CO-2, L-U]**
e. Define i) Guage pressure ii) Atmospheric pressure. **[CO-2, L-R]**
f. Give classification of level measuring methods/ instruments. **[CO-3, L-R]**
g. List the different types of orifice plates used for flow measurement. **[CO-4, L-R]**
h. Define temperature also write its units. **[CO-5, L-R]**
i. Draw different shape of thermistor (any four). **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Describe with neat diagram the working of capacitive transducer whose principle based on dielectric constant for displacement measurement. **[CO-1, L-A]**
b. Draw neat diagram of dead weight tester also write calibration procedure of pressure guage (any two points). **[CO-2, L-U]**
c. Describe the operation of air purge system with neat sketch. **[CO-3, L-U]**
d. Explain the construction and working of rotameter. **[CO-4, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Describe briefly construction and working of c-type bourdon tube with neat diagram. **[CO-2, L-U]**
b. Draw neat labelled diagram of ultrasonic type liquid level transducer also write its any two advantages. **[CO-3, L-A]**
c. Explain with neat schematic magnetic type flow meter. **[CO-4, L-U]**
d. State the temperature range and material used for following types of thermocouple i) J-type ii) K-type iii) T-type iv) S-type. **[CO-5, L-A]**

Q. 4 Attempt any FOUR **12 Marks**

a. Distinguish between bonded and unbonded type strain guage (any three points). **[CO-1, L-A]**

b. Draw a neat diagram of U-tube manometer also state its two applications. **[CO-2, L-A]**

c. Distinguish between nuclear radiation type and radar type liquid level measuring transducer (any three points). **[CO-3, L-A]**

d. State the working principle of bimetallic strip thermometer with suitable diagram. **[CO-5, L-U]**

e. Enlist the different types of pyrometer and write any two selection criteria of temperature transducer. **[CO-5, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Explain the construction & working of LVDT for linear displacement measurement also its two advantages. **[CO-1, L-U]**

b. Draw neat label diagram of venturi-meter and explain briefly its working for flow measurement. **[CO-4, L-A]**

c. Explain the working of RTD with its constructional diagram also list the types of RTD compensation circuits. **[CO-5, L-A]**

****End****

EVEN 2025-26 **IS23112**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E&C) (Sandwich Pattern)**
Course Title : **Biomedical Instrumentation**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. List the challenges encountered during measuring bio signals from living system. **[CO-1, L-R]**
b. Name any four physiological systems of human body. **[CO-1, L-R]**
c. Name the electrical signal generated by following body organs: a) Heart b) Brain **[CO-2, L-R]**
d. Identify the body organ which generates following bio signals: a) EOG b) ERG **[CO-2, L-R]**
e. Draw and label ECG waveform. **[CO-2, L-R]**
f. Draw a neat labeled diagram of Einthoven triangle for lead placement. **[CO-2, L-R]**
g. Define blood pressure. **[CO-3, L-R]**
h. Define Fibrillation. List types of defibrillators. **[CO-4, L-R]**
i. Define Micro and Macro shock. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Explain in brief the mechanism of breathing. **[CO-1, L-U]**
b. Explain action and resting potential with the help of suitable diagram. **[CO-2, L-U]**
c. Draw the block diagram of electromyography and explain it. **[CO-2, L-U]**
d. Describe the working of DC defibrillator with suitable diagram. **[CO-4, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Explain working of Spirometer with neat labeled diagram. **[CO-3, L-U]**
b. Compare internal and external pacemaker. (any four points) **[CO-4, L-A]**
c. Describe MRI imaging technique in brief. **[CO-4, L-U]**
d. Write any four effects of leakage current on human body. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Draw a neat labeled structure of brain. **[CO-1, L-U]**

b. Describe the importance of Cardiac output in human body. **[CO-1, L-A]**

c. Suggest any two electrodes used to measure ECG signal and explain any one of them. **[CO-2, L-A]**

d. Draw the block diagram of electro-encephalograph. **[CO-2, L-U]**

e. State any three applications of Pulse-oximeter. **[CO-3, L-A]**

Q. 5 Attempt any TWO **12 Marks**

a. Explain with suitable diagrams how bipolar lead configurations is used to measure the heart activity. **[CO-2, L-A]**

b. Suggest suitable instrument for indirect blood pressure measurement and explain its working. **[CO-3, L-A]**

c. State two applications for each of the following;
a) X-ray machine
b) Ultrasonography
c) CT-scan **[CO-4, L-U]**

****End****

EVEN 2025-26 **IS23101**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E&C) (Sandwich Pattern)**
Course Title : **Principles of Measurement**

2:30 Hours / 60 marks Enrolment No. | | | | | | | | | | |

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define Measurement. **[CO-1, L-R]**
b. List the different types of Standards. **[CO-1, L-R]**
c. Define: i) Sensors ii) Transducers. **[CO-2, L-R]**
d. Draw Piezoelectric Transducer and label it. **[CO-2, L-U]**
e. Define heat & temperature. **[CO-3, L-R]**
f. State Pascal's law for pressure. **[CO-4, L-R]**
g. Define: i) Gauge pressure ii) Atmospheric pressure. **[CO-4, L-R]**
h. List direct methods of Level Measurement. **[CO-5, L-R]**
i. Define Rate of flow. **[CO-6, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Explain with neat sketch of generalized block diagram of Instrumentation system. **[CO-1, L-U]**
b. Describe the working principle of capacitive transducer with neat sketch. **[CO-2, L-U]**
c. Name the transducer working on Seeback effect & explain it with neat diagram. **[CO-3, L-A]**
d. Compare single limb Manometer & 'U' tube Manometer (any four points.) **[CO-4, L-A]**

Q. 3 Attempt any THREE **12 Marks**

a. Explain the operation of Bimetallic Strip Thermometer with suitable diagram. **[CO-3, L-U]**
b. Explain the principle of working of 'C' type Bourdon tube with neat sketch. **[CO-4, L-U]**
c. Explain working principle of Ultrasonic type level measurement system with labeled diagram. **[CO-5, L-U]**
d. Compare Laminar & Turbulent flow (any four points) **[CO-6, L-A]**

Q. 4 Attempt any FOUR **12 Marks**

a. Define the following terms.
i) Accuracy ii) Precision iii) Sensitivity **[CO-1, L-U]**
b. State the principle operation of Strain gauge with neat diagram. **[CO-2, L-U]**

c. Explain the basic concept of thermal conductivity. [CO-3, L-U]
d. State the working of Linear type potentiometer with suitable diagram for level measurement. [CO-5, L-U]
e. Illustrate working of P^H electrode with suitable diagram. [CO-5, L-A]

Q. 5 Attempt any TWO **12 Marks**

a. Compare between Active transducers & Passive transducers with example. (any six points) [CO-1, L-A]
b. Illustrate principle of operation of Variable Inductance type LVDT transducer with suitable diagram. Also list its any two applications. [CO-2, L-A]
c. Compare between Orifice Plate & Venturi meter for flow measurement with diagram, working principle & applications (any two) [CO-6, L-A]

****End****

EVEN 2025-26 **IS23106**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E&C) (Sandwich Pattern)**
Course Title : **Control System & Applications**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define closed loop control system and state one example. **[CO-1, L-R]**
b. State one example of time variant and time invariant control system. **[CO-1, L-U]**
c. Draw unit impulse input and define. **[CO-2, L-R]**
d. State different test inputs with their equations. **[CO-3, L-R]**
e. Define steady state error. **[CO-3, L-U]**
f. Define BIBO stability with example. **[CO-4, L-R]**
g. State the working principle of DC motor. **[CO-5, L-R]**
h. List the components required for DC motor position control. **[CO-5, L-R]**
i. State the classification of PM DC motor. **[CO-5, L-U]**

Q.2 Attempt any THREE **12 Marks**

a. Define complex variable and explain its function in control system. **[CO-1, L-U]**
b. Explain with example i) Multiplication by constant ii) Sum & difference theorems of laplace transform.. **[CO-1, L-A]**
c. Draw block diagram of control system and explain with one practical example. **[CO-2, L-U]**
d. Describe the elements of mechanical modeling for rotational motion. **[CO-2, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Find the laplace transform of the following equations i) $y(t)=3\frac{d^2x}{dt^2}+7\frac{dx}{dt}+10$ ii) $y(t)=3\int_0^t x^2dt+\int_0^t xdt+5$. **[CO-1, L-A]**
b. Explain time response of first order system for unit ramp input. **[CO-3, L-U]**
c. Explain Hurwitz stability criterion. **[CO-4, L-U]**
d. Explain robotic control system with neat diagram. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Write the poles and zeros of the following system $G(S) = \frac{100(S+1)}{S^2(S+5)(S+7)}$. **[CO-1, L-R]**

b. Write mechanical equation and draw model for incremental encoder. **[CO-2, L-A]**

c. Draw a neat labeled diagram for the step response of second order system. **[CO-3, L-A]**

d. A system having characteristic equation $1+G(S)H(S)-S^3 - 6S^2 + 11S + 6$ find the stability with Routh's criterion. **[CO-4, L-A]**

e. Explain torque-speed characteristic of DC motor. **[CO-5, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Explain multiple input multiple output (MIMO) transfer function with suitable example. **[CO-2, L-A]**

b. Calculate the different error constants and steady state error for following system $G(S) = \frac{50}{S^2(S+7)(S+11)}$; $H(S) = 1$ input r (t) = 2t. **[CO-3, L-A]**

c. Explain sun seeker system with neat diagram. **[CO-5, L-A]**

****End****

EVEN 2025-26 **IS23502**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) (Sandwich Pattern)**
Course Title : **Embedded System Microcontrollers**

2:30 Hours / 60 marks Enrolment No. | | | | | | | | |

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define the term embedded system. **[CO-1, L-R]**
b. Classify the embedded system on the basis of performance and functional requirement. **[CO-1, L-U]**
c. List any two SFRs related to timers in 8051 microcontroller. **[CO-2, L-R]**
d. State any four features of Atmega 328P microcontroller. **[CO-3, L-R]**
e. State function of the Arduino pins (i) PWM (ii) Aref. **[CO-3, L-U]**
f. Mention the range of any two data types used in Arduino programming. **[CO-3, L-A]**
g. Classify the memories. **[CO-4, L-R]**
h. Draw circuit for SRAM memory. **[CO-4, L-U]**
i. State the Arduino pins used for DC motor speed control. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. List different characteristics of embedded system and explain any two. **[CO-1, L-R]**
b. Draw pin diagram of 8051 microcontroller and state function of (i) ALE and (ii) $\overline{EA}$ **[CO-2, L-U]**
c. Draw format for SCON register and explain function of each bit. **[CO-2, L-A]**
d. Explain block diagram of Arduino board. **[CO-3, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Explain the software development tools (i) editor (ii) cross complier. **[CO-2, L-R]**
b. Explain serial.begin ( ) and serial.print ( ) functions in detail. **[CO-3, L-A]**
c. Explain ROM type memories in detail. **[CO-4, L-U]**
d. Draw interfacing diagram of LCD with 8051 microcontroller. Write the commands to (i) clear the display (ii) display ON cursor blink. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Explain Harvard architecture with neat diagram. **[CO-1, L-U]**

b. Prepare a table comparing any two Atmel make derivatives of 8051 microcontroller. (any three points) **[CO-1, L-A]**

c. Explain functions of program counter and stack pointer registers. **[CO-2, L-U]**

d. Draw and explain port pin architecture of part 1 of 8051 microcontroller. **[CO-2, L-A]**

e. Draw interfacing diagram of servo motor with Arduino. Suggest the function to control servo motor position. **[CO-5, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Explain DMA controller with neat diagram and discuss modes of transfer. **[CO-4, L-U]**

b. Draw interfacing diagram of ADC with 8051 microcontroller. Use potentiometer for analog input. Write the code to read the potentiometer voltage and send the digital data to port P2. **[CO-5, L-A]**

c. Draw interfacing diagram of ultrasonic module HC-04 with Arduino. Write code to measure distance and display on serial monitor. **[CO-5, L-A]**

****End****

EVEN 2025-26 **IS23107**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) (Sandwich Pattern)**
Course Title : **Process Control System**

2:30 Hours / 60 marks Enrolment No.

Instructions:
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define the batch process and give one example. **[CO-1, L-R]**
b. State the importance of process control system in process industries. **[CO-1, L-R]**
c. Define offset. **[CO-2, L-R]**
d. List the types of feedback controllers. **[CO-2, L-R]**
e. List the applications of Ratio control scheme. **[CO-3, L-A]**
f. Draw feed forward control system. **[CO-3, L-U]**
g. Draw ISA symbols of i) Valve body of Butterfly valve. ii) Pneumatic signal. **[CO-4, L-A]**
h. List types of Projects. **[CO-4, L-U]**
i. Define intrinsic safety. **[CO-5, L-U]**

Q.2 Attempt any THREE **12 Marks**

a. Explain the concept of feedback control system with the help of P & ID of any one process control loop. **[CO-1, L-U]**
b. Discuss any method of PID controller tuning with neat diagram and tuning table. **[CO-2, L-U]**
c. Explain the features of Piping and Instrumentation diagram (P & ID) with simple example of process control system. **[CO-4, L-A]**
d. Explain the loop checking and commissioning procedure of project. **[CO-4, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Draw and explain working of Ratio control scheme using either divider or multiplier. **[CO-3, L-U]**
b. Draw liquid level control loop and gas pressure control loop using ISA symbol. **[CO-4, L-A]**
c. Draw and explain any one hookup diagram of instrument with required bill of materials. **[CO-4, L-A]**
d. Describe the classification of hazardous areas as per NEC standard. **[CO-5, L-U]**

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Q. 4 Attempt any FOUR **12 Marks**

a. Draw P & ID of industrial temperature control loop. Name the controlled variable and manipulated variable present in the loop. **[CO-1, L-U]**

b. Define hunting effect of On- Off controller and state its practical remedies. **[CO-2, L-U]**

c. Differentiate the feedback and feed-forward control schemes (any three points) **[CO-3, L-U]**

d. Draw and explain in brief typical instrument index sheet. **[CO-4, L-A]**

e. Draw Intrinsically Safety (IS) barrier system and state the function of zener diodes and current limiting resistor in it. **[CO-5, L-A]**

Q. 5 Attempt any TWO **12 Marks**

a. Explain standard PID controller with respect to following points.
i) Control Algorithm ii) Controller Response iii) Process Response
iv) Advantages v)Disadvantages & vi) Applications. **[CO-2, L-U]**

b. Explain the operation of Cascade control system with neat block diagram and P & ID of industrial example. **[CO-3, L-U]**

c. With the help of neat block diagram, explain the major phases involved in the life cycle of project. **[CO-4, L-U]**

****End****

EVEN 2025-26 **IS23105**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation**
Course Title : **Analog Electronics**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. List any four advantages of negative feedback. **[CO-1, L-R]**
b. Classify power amplifiers. **[CO-1, L-R]**
c. State Barkhausen's criteria to sustain oscillations. **[CO-2, L-R]**
d. Draw circuit diagram of crystal oscillator. **[CO-2, L-R]**
e. Draw V-I characteristics of SCR & label it. **[CO-3, L-U]**
f. Draw symbol of : (i) TRIAC (ii) IGBT. **[CO-3, L-R]**
g. State principle of operation of inverter. **[CO-4, L-R]**
h. State use of solid state relay in power control circuits. **[CO-5, L-R]**
i. Draw circuit diagram of liquid level controller using SCR. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Draw circuit diagram and explain working of direct coupled amplifier. **[CO-1, L-U]**
b. Explain operation of Hartley oscillator with circuit diagram. **[CO-2, L-U]**
c. Draw circuit diagram and waveforms of sinusoidal PWM inverter. **[CO-4, L-U]**
d. Elaborate use of 1ϕ full control converter to control speed of DC series motor with circuit diagram. **[CO-5, L-A]**

Q. 3 Attempt any THREE **12 Marks**

a. Draw circuit diagram and explain operation of UJT relaxation oscillator. **[CO-2, L-U]**
b. Explain operation of snubber circuit for SCR protection with neat circuit diagram. **[CO-3, L-U]**
c. Describe single phase (1ϕ) full wave controlled rectifier (R-load) with circuit diagram and waveform ($\alpha = 90^0$) **[CO-4, L-A]**
d. Suggest suitable circuit for speed control of 3ϕ (three phase) induction motor. Explain same with circuit diagram and waveforms. **[CO-5, L-A]**

Q. 4 Attempt any FOUR **12 Marks**

a. Explain voltage series feedback amplifier with circuit diagram. **[CO-1, L-U]**
b. Justify use of positive feedback in oscillators. **[CO-2, L-A]**
c. Explain RC triggering method of SCR with circuit diagram. **[CO-3, L-U]**
d. TRIAC can be used for temperature control system. Justify statement **[CO-5, L-A]**
e. Explain use of TRIAC to actuate control valve. **[CO-5, L-A]**

Q. 5 Attempt any TWO **12 Marks**

a. Draw circuit diagram of RC coupled amplifier. Discuss its frequency response. **[CO-1, L-A]**

b. Suggest suitable power device having 1st and 3rd quadrant symmetric characteristics and describe its operation with any two modes. **[CO-3, L-A]**

c. Explain principle of operation of first quadrant chopper with circuit diagram and waveforms. **[CO-4, L-A]**

****End****

EVEN 2025-26 **IS23702**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) Sandwich Pattern**
Course Title : **IOT based Instrumentation**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define the term internet of things. **[CO-1, L-R]**
b. List applications of IOT (any four). **[CO-1, L-R]**
c. State types of IOT. **[CO-1, L-R]**
d. List any four IOT gateway devices. **[CO-2, L-R]**
e. State any four features of ESP32. **[CO-2, L-R]**
f. State the principle of Bluetooth technology. **[CO-3, L-R]**
g. List any four applications of HTTP-REST. **[CO-3, L-R]**
h. Define soft and hard RTOS. **[CO-4, L-R]**
i. State principle of 3D printing. **[CO-5, L-U]**

Q.2 Attempt any THREE **12 Marks**

a. Draw and explain an architecture of IOT. **[CO-1, L-U]**
b. Explain physical design of IOT with neat diagram. **[CO-1, L-U]**
c. Draw interfacing diagram of IR sensor & LED with ESP32. Write code to detect object and blink LED. **[CO-2, L-A]**
d. Draw interfacing diagram of LM35 temperature sensor. Write code to measure temperature and display on serial monitor. **[CO-2, L-A]**

Q. 3 Attempt any THREE **12 Marks**

a. Draw architecture of RTOS and explain it. **[CO-4, L-U]**
b. Explain pre-emptive type of scheduling used in RTOS. **[CO-4, L-U]**
c. Explain steps involved in object 3D printing. **[CO-5, L-U]**
d. Explain how IOT is helpful in telemedicine and teledignosis. **[CO-5, L-A]**

Q. 4 Attempt any FOUR **12 Marks**

a. Compare traditional and IOT based instrumentation systems. (any three points) **[CO-1, L-A]**
b. Draw pin diagram of ESP32. **[CO-2, L-U]**
c. Explain in brief embedded platform for IOT embedded computing. **[CO-2, L-U]**
d. Explain CoAP protocol with neat diagram. **[CO-3, L-U]**
e. Write the procedure to create webserver using node MCU. **[CO-3, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Write code to configure ESP32 to connect to Wi-Fi. Explain the code. **[CO-3, L-A]**

b. Explain multitasking in detail. **[CO-4, L-A]**

c. Draw neat diagram for home automation using IOT. Write an ALP to control appliances. **[CO-5, L-A]**

****END****

EVEN 2025-26 **IS23110**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation (E& C) (Sandwich Pattern)**
Course Title : **Industrial Automation**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define PLC. **[CO-1, L-R]**
b. List any three types for industrial automation. **[CO-1, L-R]**
c. Define scan time of PLC. **[CO-1, L-U]**
d. List any four comparison instructions of PLC. **[CO-2, L-R]**
e. State latch type instruction and write its operation. **[CO-1, L-U]**
f. State any two editors of SCADA & their functions. **[CO-2, L-R]**
g. List any two benefits of SCADA System. **[CO-3, L-R]**
h. State role of RTU in SCADA system. **[CO-3, L-R]**
i. Identify the type of tag for following
   i) Temp transmitter
   ii) Push button **[CO-3, L-A]**

Q.2 Attempt any THREE **12 Marks**

a. Explain with neat diagram analog input module of PLC. **[CO-1, L-U]**
b. Draw and explain ADD instruction of PLC. **[CO-2 L-R]**
c. Explain CTD instruction with its block diagram. **[CO-2, L-U]**
d. Draw & explain scale with parameter instruction in detail. **[CO-2, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Explain RTO instruction with neat diagram. **[CO-2, L-U]**
b. Draw a ladder diagram for following.
   i) Read input & multiply with 2
   ii) If result is greater than or equal to 100 turn ON RED LED connected to 0:0/0
   iii) Else turn ON GREEN LED connected to 0:0/1 **[CO-2, L-A]**
c. Draw a ladder diagram to control operation of diesel genset. Write I/0 list & address(Assume suitable data) **[CO-4, L-A]**
d. Draw a ladder diagram for bottle filling plant. Consider the required inputs & outputs write I/0 list & I/0 address (Assume suitable data) **[CO-4, L-A]**

Q. 4 Attempt any FOUR **12 Marks**

a. Draw block diagram of PLC and list any two status indicators used in PLC. **[CO-1, L-R]**

b. List and explain any three programming language of PLC programming. **[CO-1, L-A]**

c. A PLC has Temperature transmitter to read temperature in the range of 0^0C to 100^0 Write ladder program to represent temperature if analog input ranges from value 0 to 2048 **[CO-2, L-A]**

d. Define tag. List different types of tags. **[CO-3, L-U]**

e. Write the inputs and outputs and their address for an application of batch process (Assume suitable data) **[CO-4, L-A]**

Q. 5 Attempt any TWO **12 Marks**

a. Write a ladder program for following expressions.
   i) $Y = \bar{A}\bar{B}W + \bar{A}BX + A\bar{B}Y + ABZ$
   ii) $Yc = \bar{A}\bar{B}$
   iii) $Y1 = \bar{A}B$ **[CO-2, L-A]**

b. Compare TON & TOF (Any Six Points). **[CO-2, L-A]**

c. Draw a ladder diagram to control an elevator system. Write I/0 List and I/0 address also draw its mimic diagram. (Assume suitable data) **[CO-4, L-A]**

****End****

EVEN 2025-26

IS23102

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) (Sandwich Pattern)**
Course Title : **Control System Components**

2:30 Hours/ 60 marks Enrolment No.

Instructions:
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. List types of hydraulic actuators. [CO-1, L-R]
b. Draw symbols of (i) 2/2 and (ii) 4/2 DCV's. [CO-1, L-U]
c. Enlist the types of air compressors. [CO-1, L-R]
d. Give classification of control valve. [CO-3, L-U]
e. State the working principle of solenoid valve. [CO-3, L-R]
f. Define [illegible] [CO-4, L-R]
g. Draw the construction diagram of an electromechanical relay. [CO-4, L-R]
h. Draw neat sketch of rupture disc. [CO-5, L-U]
i. State any two applications of safety valve. [CO-5, L-R]

Q.2 Attempt any THREE **12 Marks**

a. Compare single acting cylinder and double acting cylinder. [CO-1, L-A]
b. Explain the working of pneumatic relay with neat diagram. [CO-2, L-U]
c. List the types of control valve actuators. Explain any one in brief. [CO-3, L-A]
d. Draw construction diagram of a DC motor. [CO-4, L-A]

Q. 3 Attempt any THREE **12 Marks**

a. Explain the working of time delay valve with neat schematic. [CO-1, L-U]
b. Distinguish between I/P converter and P/I converter (any four points). [CO-2, L-A]
c. List and draw the flow characteristics of control valve. [CO-3, L-U]
d. Illustrate working of overload relay with neat schematic diagram. [CO-4, L-A]

Q. 4 Attempt any FOUR **12 Marks**

a. Draw block diagram of pneumatic system. [CO-2, L-U]
b. Explain the necessity of valve positioner in brief. [CO-3, L-U]
c. Suggest a small ON/OFF type control valve which can be operated by an electric signal. [CO-3, L-U]
d. Compare electromechanical relay and solid state relay. (any three points) [CO-4, L-A]
e. Explain function of alarm annunciator with neat sketch. [CO-5, L-U]

Q. 5 Attempt any TWO **12 Marks**

a. Explain the operation of following valves with an application.
   (i) Check valve
   (ii) Shuffle valve **[CO-1, L-A]**

b. Explain the need of circuit breakers. Also list the types and state working principle of any one. **[CO-4, L-U]**

c. Distinguish : (i) Pneumatic system
   (ii) Hydraulic system and
   (iii) Electric system **[CO-5, L-A]**

****End****

EVEN 2025-26

IS23108

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E&C) (Sandwich Pattern)**
Course Title : **Unit Operation & Instrumentation**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO -COURSE OUTCOMES; L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define unit operation. List its two examples. **[CO-1, L-R]**
b. List any two unit operations in oil refinery. **[CO-1, L-R]**
c. Explain reversible process. **[CO-1, L-U]**
d. Draw flow sheet symbol of boiler. **[CO-2, L-R]**
e. Draw flow sheet symbol of heat exchanger. **[CO-2, L-R]**
f. List applications of heat exchanger (any two). **[CO-2, L-U]**
g. Define distillation. **[CO-3, L-R]**
h. Define economy of evaporator. **[CO-4, L-R]**
i. State the need of dryer. **[CO-4, L-U]**

Q.2 Attempt any THREE **12 Marks**

a. Draw and explain overhead control in distillation. **[CO-3, L-A]**
b. Give detail classification of heat exchanger. **[CO-2, L-U]**
c. Draw and explain construction & working of tray dryer. **[CO-4, L-U]**
d. Explain construction and working of continuous crystallizer with suitable diagram. **[CO-5, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Compare continuous and batch process (any four points). **[CO-1, L-A]**
b. Compare flash and fractionaling distillation process (any four points). **[CO-3, L-A]**
c. Explain any four interlocks in boiler. **[CO-2, L-A]**
d. Draw a neat labeled diagram of draft Tula baffle crystallizer. List its any two advantages. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Describe operation of thermal power plant. **[CO-1, L-U]**
b. Explain the role of BMS with the help of neat labeled sketch. **[CO-2, L-U]**
c. List & explain any three factors affecting rate of drying. **[CO-4, L-U]**
d. Draw and explain single effect evaporator. **[CO-4, L-U]**
e. State the importance of crystal size. **[CO-5, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Explain the cascade control scheme of heat exchanger with suitable diagram. **[CO-2, L-A]**

b. Explain construction and working of fractionating distillation column with suitable diagram. **[CO-3, L-U]**

c. Discuss and explain feedback control scheme in evaporator with suitable diagram. **[CO-4, L-A]**

****End****

EVEN 2025-26 **IS23103**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation (E & C) (Sandwich Pattern)**
Course Title : **Basics of Electrical & Electronics Engineering**

2:30 Hours / 60 marks Enrolment No. | | | | | | | | | | | |

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES. L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define Current & State it's unit. **[CO-1, L-R]**
b. State Ohm's law with equation. **[CO-1, L-R]**
c. State Thevenin's theorem. **[CO-2, L-R]**
d. State Maximum power transfers theorem. **[CO-2, L-R]**
e. Define – i) Ripple Factor
ii) Ripple Frequency. **[CO-3, L-R]**
f. List any 02 applications of LED. **[CO-3, L-R]**
g. List types of Transistor. **[CO-4, L-R]**
h. Define operating point of transistor. **[CO-4, L-R]**
i. Enlist types of Passive Filters. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Explain Kirchoff's voltage law & current law with its proper equation. **[CO-1, L-U]**
b. Describe power factor & it's significance. **[CO-2, L-U]**
c. Explain operation of half wave rectifier with circuit diagram & input & output waveforms. **[CO-3, L-U]**
d. Explain voltage divider bias with circuit diagram. **[CO-5, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Explain the concept of i) Electric Potential
ii) E.M.F. **[CO-1, L-U]**
b. Describe with Triangle i) Active Power
ii) Reactive Power
iii) Apparent power. **[CO-2, L-U]**
c. Distinguish in between clipper & clamper circuits (any 04 points) **[CO-3, L-A]**
d. Explain working of Common Emitter Configuration with proper circuit diagram. **[CO-4, L-U]**

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Q. 4 Attempt any FOUR **12 Marks**

a. Compare Alternating current (AC) & Direct current (DC) (any 03 points) **[CO-1, L-A]**

b. Differentiate in between star & Delta connections (any 03 Points) **[CO-2, L-A]**

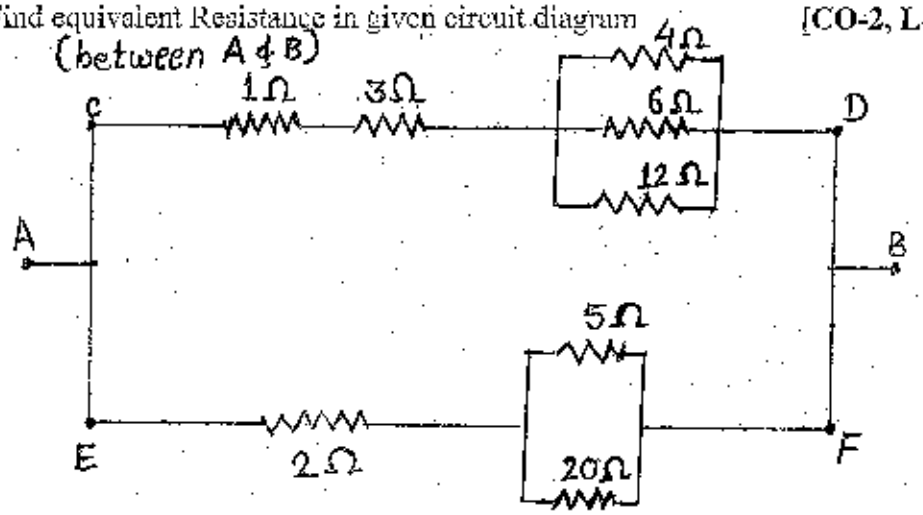
c. Describe Zener diode as a voltage regulator with proper circuit diagram. **[CO-3, L-U]**

d. Explain the working principle of PNP transistor with diagram. **[CO-4, L-U]**

e. Describe load regulation & line regulation. **[CO-5, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Find equivalent Resistance in given circuit diagram **[CO-2, L-A]**



b. Compare MOSFET & JFET (any 06 points) **[CO-4, L-A]**

c. Explain working of D.C. Regulated power supply with suitable block diagram. **[CO-5, L-U]**

****End****

EVEN 2025-26 **IS23501**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E&C) (Sandwich Pattern)**
Course Title : **Digital Techniques**

2:30 Hours / 60 marks Enrolment No.

Instructions:
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Write the radix of binary, octal, decimal and hexadecimal number system. **[CO-1, L-R]**
b. Obtain 1's complement of $(11011001)_2$. **[CO-1, L-R]**
c. Convert $(85.63)_{10}$ into binary number. **[CO-1, L-A]**
d. Write example of Boolean expression for SOP and POS. **[CO-2, L-U]**
e. Draw symbol & truth table for EX-OR gate. **[CO-2, L-U]**
f. State the necessity of multiplexers. **[CO-3, L-R]**
g. List the types of demultiplexers. **[CO-3, L-R]**
h. State the major difference between sequential & combinational logic circuits (any two). **[CO-4, L-U]**
i. State function of preset and clear in flip flop. **[CO-4, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Perform $(0100)_2-(1001)_2$ by 2's complement methods. **[CO-1, L-A]**
b. State De Morgan's theorems and prove any one. **[CO-2, L-R,A]**
c. Design 1-bit comparator using K-map technique. **[CO-3, L-A]**
d. Describe the operation of SR flip flop using NAND gates only. **[CO-4, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Define the following characteristics of logic gates i) Noise margin ii) Propogation delay. **[CO-2, L-R]**
b. Draw the OR gate and AND gate using NAND gate only also write its truth table. **[CO-2, L-A]**
c. Draw logic diagram of half subtrator using K-map simplification and write truth table. **[CO-3, L-U]**
d. Describe the working of JK flip flop with truth table & logic diagram. **[CO-4, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Simplify following expression by Boolean algebra & draw circuit diagram $Y = \bar{A}(A + \bar{B}) + \bar{B}(\bar{A} + B)$. **[CO-2, L-A]**

b. Draw 16:1 MUX tree using 4:1 MUX. **[CO-3, L-U]**

c. Draw pin diagram of IC7483 4-bit parallel binary adder. **[CO-3, L-U]**

d. Draw symbol and truth table of D-flip flop and T-flip flop. **[CO-4, L-R]**

e. Give classification of shift registers. **[CO-4, L-R]**

Q. 5 Attempt any TWO **12 Marks**

a. Convert i) $(255)_{10} = (?)_{16} = (?)_8$.

ii) $(157)_{10} = (?)_{BCD} = (?)_{EXCESS-3}$. **[CO-1, L-A]**

b. Find the reduced form of following function & realize reduced expression using gates. $f(A,B,C,D) = \sum m(0,1,5,9,13,14,15) + d(3,4,7,10,11)$. **[CO-2, L-A]**

c. Design a 4-bit synchronous counter and draw its logic diagram. **[CO-4, L-A]**

****End****

EVEN 2025-26

IS23111

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E&C) (Sandwich Pattern)**
Course Title : **Analytical Instrumentation**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary.
6. CO=COURSE OUTCOMES, L=LEVELS

Q.1 Attempt any SIX **12 Marks**

a. Define analytical instrumentation. **[CO-1, L-R]**
b. List any two radiation sources of analytical instrumentation. **[CO-1, L-R]**
c. State the basic working principle of colorimeter. **[CO-2, L-R]**
d. List any two applications of spectrophotometer. **[CO-2, L-R]**
e. Enlist types of chromatography. **[CO-3, L-R]**
f. State the basic working principle of mass-spectrometer. **[CO-3, L-R]**
g. List P^H measurement methods. **[CO-4, L-R]**
h. List any two applications of infrared gas analyzer. **[CO-4, L-R]**
i. Enlist different types of gas pollutant. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Explain functions of each block system of analytical instrumentation with suitable block diagram. **[CO-1, L-U]**
b. Explain Beer's & Lambert's law with suitable labeled diagram. **[CO-2, L-U]**
c. Compare gas chromatography & high performance liquid chromatography (any 4 points). **[CO-3, L-A]**
d. Distinguish between glass electrode & calomel electrode (any four points). **[CO-4, L-A]**

Q. 3 Attempt any THREE **12 Marks**

a. Describe working of flame photometer with suitable labeled diagram. **[CO-2, L-U]**
b. Distinguish in between stationary phase & mobile phase in chromatography (any four points). **[CO-3, L-A]**
c. Describe working of thermal conductivity analyzer with labeled diagram. **[CO-4, L-U]**
d. Explain necessity of monitoring pollutants for environmental sustainability. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Compare optical filters & absorption type filters (any three points). **[CO-1, L-A]**

b. State basic concept of time-of flight mass-spectrometer with labeled diagram. **[CO-3, L-U]**

c. List any two applications of paramagnetic type oxygen analyzer with suitable diagram. **[CO-4, L-U]**

d. Explain representation of concentration of gas pollutants with suitable formulae. **[CO-5, L-A]**

e. Explain working of carbon monoxide gas pollutant measurement method using gas chromatography. **[CO-5, L-U]**

Q. 5 Attempt any TWO **12 Marks**

a. Draw block diagram of NMR spectrometer & explain the role of nuclear spin. Also list any two applications. **[CO-2, L-A]**

b. Describe working of gas chromatography mass-spectrometer (GCMS) with suitable block diagram. **[CO-3, L-U]**

c. Explain complete blood gas analyzer with block diagram. **[CO-4, L-U]**

****End****

EVEN 2025-26 **IS23201**

GOVERNMENT POLYTECHNIC MUMBAI
TERM END EXAMINATION

Programme : **Instrumentation Engineering (E & C) (Sandwich Pattern)**
Course Title : **Power Plant Instrumentation**

2:30 Hours / 60 marks Enrolment No.

***Instructions*:**
1. Attempt all the questions.
2. Illustrate your answers with neat sketches wherever necessary.
3. Use of Mathematical Tables, Steam Table and Pocket Calculator (non-programmable) is permissible.
4. Marks on Right Hand Side indicate full marks for the question.
5. Assume suitable additional data, if necessary
6. CO- COURSE OUTCOMES, L=LEVELS.

Q.1 Attempt any SIX **12 Marks**

a. Define Boyle's law-1. **[CO-1, L-R]**
b. Enlist any four sources of energy to generate electrical energy. **[CO-2, L-R]**
c. List any four advantages of gaseous fuels. **[CO-2, L-R]**
d. Enlist four component of Turbo Generator. **[CO-3, L-R]**
e. Enlist any two safety measures of Nuclear power plant. **[CO-4, L-R]**
f. Define: i) Nuclear Fission ii) Nuclear Fusion. **[CO-4, L-R]**
g. State importance of Vibration measurement in power plant. **[CO-5, L-U]**
h. Give four application of oxygen analyser. **[CO-5, L-A]**
i. Enlist any four sources of vibration in power plant. **[CO-5, L-R]**

Q.2 Attempt any THREE **12 Marks**

a. Explain with neat diagram of pressurized water reactor. **[CO-4, L-U]**
b. Explain Rankine cycle with suitable block diagram. **[CO-1, L-U]**
c. Draw layout diagram of steam power plant & explain its working. **[CO-2, L-U]**
d. Explain with neat diagram of feed forward control system of furnace draft control of Boiler. **[CO-3, L-U]**

Q. 3 Attempt any THREE **12 Marks**

a. Explain following laws of Conservation of energy.
i) Constant volume process ii) Constant pressure process. **[CO-1, L-U]**
b. Explain with neat diagram of ultimate analysis of coal. **[CO-2, L-U]**
c. Draw neat diagram of water cooled Turbo generator & explain its working. **[CO-3, L-U]**
d. Explain with neat diagram Zirconium type measurement system. **[CO-5, L-U]**

Q. 4 Attempt any FOUR **12 Marks**

a. Differentiate between enthalpy and entropy of thermodynamic system. **[CO-1, L-A]**
b. Distinguish between Tidal energy and wind energy. (any three points) **[CO-2, L-A]**
c. State the working principle of Turbo generator. **[CO-3, L-A]**

d. State advantages and disadvantages of Boiler water reactor. **[CO-4, L-U]**
e. State the function of Nox Reduction in power plant. **[CO-5, L-A]**

Q. 5 Attempt any TWO **12 Marks**

a. Draw and explain steam circuit of thermal power plant. Also list any two essential requirement of steam power plant. **[CO-2, L-A]**
b. Name the four equipment used for ash handling system. Explain briefly ash handling system with suitable schematic. **[CO-3, L-A]**
c. Suggest name of four components used in nuclear power plant. Describe operation of nuclear power plant with neat schematic. **[CO-4, L-A]**

****End****