INVITATION FOR QUOTATION

TEQIP-III/2018/uiej/Shopping/23 **03-May-2018**

To,

Sub: Invitation for Quotations for supply of Goods for Control System Lab

Dear Sir,

1. You are invited to submit your most competitive quotation for the following goods with item wise detailed specifications given at Annexure I,

Sr. No	**Brief Description**	**Quantity**	**Delivery Period(In days)**	**Place of Delivery**	**Installation Requirement (if any)**
1	Ac Position Control System (Eco)	1	40	JAUNPUR, UP	
2	Compensation Design	1	40	JAUNPUR, UP	
3	Linear System Simulator	1	40	JAUNPUR, UP	
4	Magnetic Amplifier Synchro Transmitter – Receiver	1	40	JAUNPUR, UP	
5	PC-based analog and digital motor control teaching set	2	40	JAUNPUR, UP	
6	PID Controller	1	40	JAUNPUR, UP	

7	Potentiometers as an Error Detector	1	40	JAUNPUR, UP	
8	Speed Control of AC Motor Using TRIAC	1	40	JAUNPUR, UP	
9	Speed Control of Universal Motor Using SCR	1	40	JAUNPUR, UP	
10	Study of Second Order Networks	1	40	JAUNPUR, UP	
11	Study of Servo Motor	1	40	JAUNPUR, UP	
12	Synchro control transformer	1	40	JAUNPUR, UP	
13	Temperature Control System	1	40	JAUNPUR, UP	

2. Government of India has received a credit from the International Development Association (IDA) towards the cost of the **Technical Education Quality Improvement Programme[TEQIP]-Phase III** Project and intends to apply part of the proceeds of this credit to eligible payments under the contract for which this invitation for quotations is issued.
3. Quotation,

   3.1 The contract shall be for the full quantity as described above.

   3.2 Corrections, if any, shall be made by crossing out, initialing, dating and re writing.

   3.3 All duties and other levies payable by the supplier under the contract shall be included in the unit price.

   3.4 Applicable taxes shall be quoted separately for all items.

   3.5 The prices quoted by the bidder shall be fixed for the duration of the contract and shall not be subject to adjustment on any account.

   3.6 The Prices should be quoted in Indian Rupees only.

4. Each bidder shall submit only one quotation.
5. Quotation shall remain valid for a period not less than **40** days after the last date of quotation submission.
6. Evaluation of Quotations,

   The Purchaser will evaluate and compare the quotations determined to be substantially responsive i.e. which

   6.1 are properly signed ; and

   6.2 confirm to the terms and conditions, and specifications.
7. The Quotations would be evaluated for all items together.
8. Award of contract:

   The Purchaser will award the contract to the bidder whose quotation has been determined to be substantially responsive and who has offered the lowest evaluated quotation price.

   8.1 Notwithstanding the above, the Purchaser reserves the right to accept or reject any quotations and to cancel the bidding process and reject all quotations at any time prior to the award of contract.

   8.2 The bidder whose bid is accepted will be notified of the award of contract by the Purchaser prior to expiration of the quotation validity period. The terms of the accepted offer shall be incorporated in the purchase order.
9. Payment shall be made in Indian Rupees as follows:

   Delivery and Installation - 100% of total cost

   Satisfactory Acceptance - 0% of total cost

10. All supplied items are under warranty of **12** months from the date of successful acceptance of items.
11. You are requested to provide your offer latest by **12:00** hours on **18-May-2018 .**
12. Detailed specifications of the items are at Annexure I.
13. Training Clause (if any) **Required**
14. Testing/Installation Clause (if any) **Required**

15. Information brochures/ Product catalogue, if any must be accompanied with the quotation clearly indicating the model quoted for.
16. Sealed quotation to be submitted/ delivered at the address mentioned below,

    Dr. Rajnish Bhasker , Procurement Officer TEQIP-III, VBS Purvanchal University Campus, Shahganj Road, Jaunpur, UP pin-222003
17. We look forward to receiving your quotation and thank you for your interest in this project.

(Authorized Signatory)

Name & Designation

Annexure I

Sr. No	Item Name	Specifications
1	Ac Position Control System (Eco)	**Salient Features:**Should have facility to work with Analog as well as Digital PID. Should have facility to monitor behavior of the PID output & process variable on PC screen. User settable PID controller parameters for P, PI, PD & PID operations. Should have facility of graph printing for laboratory journal entries. Electronic desk should carry useful experimental resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels. Connection through sturdy 4mm Banana sockets & Patch cords. Set of Students workbook & Instructor's Guide should be provided. PC is not in scope of supply but P4/XP with parallel port/ USB port needed. **Basic Resources on Electronic desk:**· DC supply +/- 12V,500mA.· 1ϕ sine reference for cosine firing 30Vpp max.· 17Vdc 500mA unregulated for driving pulse transformer**Display:**A) DPM – 2nos.a) For temp upto 100ºC & intensity in Lux (2000), b) For temp upto 500ºCB) AnalogMeter – 2nos.a) Center zero for display of process error (+9V), b) For MV/SP (0-2.5V)**Operating voltage:** selectable 220-240Vac +10% 50Hz **Operating modes:** Online monitoring / Data acquisition / PID Software should be provided.Simulator Mode, b) Process Monitoring Mode, c) PID controller Mode **Built in function generator:** O/p waveform selectable sine, triangular & square, O/p freq. range from 0.016Hz to 166Hz, 4 steps & frequency control pot, Variable amplitude using potentiometer from ±9V max. **Computer Interface Adapter / CIA** • Optoisolated Adaptor to prevent damage to PC parallel port/ USB port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channe• : o/p 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max • USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed

		in 25 Pin D shell using Type A to mini B cable. • V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V **Controller selection P, PI, PD, PID with slide switch** Parameter settings: Integral Time Ti (0.5-25Sec), Derivative Time Td (0-2Sec), Proportional Band Pb (5-200%), Set point (-9V- +9V) **Servo Interface panel** Control Interface circuit for AC & DC servo motor, signal conditioning circuit for speed sensor to O/P 0 - 2.5VDC (2500RPM) with speed direction. Level shifter 0 - 2.5V to ± 9V (2nos). Relay control characteristics :Hystersis, Dead band & Relay control circuit (2term & 3 term), process block for 2Nos. of 1st order lag / integral + transport lag, error and gain block for process simulation. Phase plane analysis by display of X & X dotShould have following real life process **AC servo position control** AC geared (50:1) 2 phase servo motor. Main winding 230VAC control winding: 6VAC/1A O/P shaft RPM 25 (D), ND RPM 2500. Loading: Using small PMDC motor @ 12V/1A max. Servo amplifier with built in 12V/3A, Sensor: Servo pot as position feedback for position control. **List of Experiments** 1) Close loop position control using 2/3 step controller. 2) Torque-Speed Characteristics Of AC Servo Motor Close loop control of AC SERVO Motor 3) Set Point Position Control of AC Motor 4) Close loop using 2/3 step controller with simulated processes
2	Compensation Design	**Salient Features:**Should have facility to work with Analog as well as Digital PID. Should have facility to monitor behavior of the PID output & process variable on PC screen. User settable PID controller parameters for P, PI, PD & PID operations. Should have facility of graph printing for laboratory journal entries. Electronic desk should carry useful experimental resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels. Connection through sturdy 4mm Banana sockets & Patch cords. Set of Students workbook & Instructor's Guide should be provided. PC is not in scope of supply but P4/XP with parallel port/ USB port needed. **Basic Resources on Electronic desk:**· DC supply +/- 12V,500mA.· 1ϕ sine reference for cosine firing 30Vpp max.· 17Vdc 500mA unregulated for driving pulse transformer**Display:**A) DPM – 2nos.a) For temp upto 100ºC & intensity in Lux (2000), b) For temp upto 500ºCB) AnalogMeter – 2nos.a) Center zero for display of process error (+9V), b) For MV/SP (0-2.5V)**Operating voltage:** selectable 220-240Vac +10% 50Hz **Operating modes:** Online monitoring / Data acquisition / PID Software should be provided.Simulator Mode, b) Process Monitoring Mode, c) PID controller Mode **Built in function generator:** O/p waveform selectable sine, triangular & square, O/p freq. range from 0.016Hz to 166Hz, 4 steps & frequency control pot, Variable amplitude using potentiometer from ±9V max. **Computer Interface Adapter / CIA** • Optoisolated Adaptor to prevent damage to PC parallel port/ USB port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channe• : o/p 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max • USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 Pin D shell using Type A to mini B cable. • V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V **Controller selection P, PI, PD, PID with slide switch**

		Parameter settings: Integral Time Ti (0.5-25Sec), Derivative Time Td (0-2Sec), Proportional Band Pb (5-200%), Set point (-9V- +9V) **Process Simulator Panel**[Provided with 49 banana tags] • Functional blocks for Lag (3 No.), Integrator (3 No.), Transport Lag (1 No.), Summer (2 No.), Gain (1 No.), Inverter (2 No.) for constructing simulated Type 0,1,2,3 & 1st, 2nd, 3rd Order processes to work under PID. • Experiments with Lead / Lag / Lead - Lag compensators to control behaviour of matching processes using above function blocks. • Open loop & close loop response of processes under different P, PI, PID - Analog or Digital controllers. Experimental varification of PID Controller settings (Pb, Ti, Td) • Auto Tuning explained using Ziegler Nicolas I & II. • Fast (10mS) & slow (1sec) mode selection for all processes to observe response on either CRO or PC using CIA. • Drawing Bode plot &Nyquist plots, transfer function determination.
3	Linear System Simulator	**Salient Features:**Should have facility to work with Analog as well as Digital PID. Should have facility to monitor behavior of the PID output & process variable on PC screen. User settable PID controller parameters for P, PI, PD & PID operations. Should have facility of graph printing for laboratory journal entries. Electronic desk should carry useful experimental resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels. Connection through sturdy 4mm Banana sockets & Patch cords. Set of Students workbook & Instructor's Guide should be provided. PC is not in scope of supply but P4/XP with parallel port/ USB port needed. **Basic Resources on Electronic desk:**· DC supply +/- 12V,500mA.· 1ϕ sine reference for cosine firing 30Vpp max.· 17Vdc 500mA unregulated for driving pulse transformer**Display:**A) DPM – 2nos.a) For temp upto 100ºC & intensity in Lux (2000), b) For temp upto 500ºCB) AnalogMeter – 2nos.a) Center zero for display of process error (+9V), b) For MV/SP (0-2.5V)**Operating voltage:** selectable 220-240Vac +10% 50Hz **Operating modes:** Online monitoring / Data acquisition / PID Software should be provided.Simulator Mode, b) Process Monitoring Mode, c) PID controller Mode **Built in function generator:** O/p waveform selectable sine, triangular & square, O/p freq. range from 0.016Hz to 166Hz, 4 steps & frequency control pot, Variable amplitude using potentiometer from ±9V max. **Computer Interface Adapter / CIA** • Optoisolated Adaptor to prevent damage to PC parallel port/ USB port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channe• : o/p 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max • USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 Pin D shell using Type A to mini B cable. • V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V **Controller selection P, PI, PD, PID with slide switch** Parameter settings: Integral Time Ti (0.5-25Sec), Derivative Time Td (0-2Sec), Proportional Band Pb (5-200%), Set point (-9V- +9V) **Process Simulator Panel**[Provided with 49 banana tags]

		⍰ Functional blocks for Lag (3 No.), Integrator (3 No.), Transport Lag (1 No.), Summer (2 No.), Gain (1 No.), Inverter (2 No.) for constructing simulated Type 0,1,2,3 & 1st, 2nd, 3rd Order processes to work under PID. ⍰ Experiments with Lead / Lag / Lead - Lag compensators to control behaviour of matching processes using above function blocks. ⍰ Open loop & close loop response of processes under different P, PI, PID - Analog or Digital controllers. Experimental varification of PID Controller settings (Pb, Ti, Td) ⍰ Auto Tuning explained using Ziegler Nicolas I & II. ⍰ Fast (10mS) & slow (1sec) mode selection for all processes to observe response on either CRO or PC using CIA. ⍰ Drawing Bode plot &Nyquist plots, transfer function determination.
4	Magnetic Amplifier Synchro Transmitter – Receiver	**Salient Features:**Should have facility to work with Analog as well as Digital PID. Should have facility to monitor behavior of the PID output & process variable on PC screen. User settable PID controller parameters for P, PI, PD & PID operations. Should have facility of graph printing for laboratory journal entries. Electronic desk should carry useful experimental resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels. Connection through sturdy 4mm Banana sockets & Patch cords. Set of Students workbook & Instructor's Guide should be provided. PC is not in scope of supply but P4/XP with parallel port/ USB port needed. **Basic Resources on Electronic desk:**· DC supply +/- 12V,500mA.· 1ϕ ⍰sine reference for cosine firing 30Vpp max.· 17Vdc 500mA unregulated for driving pulse transformer**Display:**A) DPM – 2nos.a) For temp upto 100ºC & intensity in Lux (2000), b) For temp upto 500ºCB) AnalogMeter – 2nos.a) Center zero for display of process error (+9V), b) For MV/SP (0-2.5V)**Operating voltage:** selectable 220-240Vac +10% 50Hz **Operating modes:** Online monitoring / Data acquisition / PID Software should be provided.Simulator Mode, b) Process Monitoring Mode, c) PID controller Mode **Built in function generator:** O/p waveform selectable sine, triangular & square, O/p freq. range from 0.016Hz to 166Hz, 4 steps & frequency control pot, Variable amplitude using potentiometer from ±9V max. **Computer Interface Adapter / CIA** • Optoisolated Adaptor to prevent damage to PC parallel port/ USB port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channe• : o/p 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max • USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 Pin D shell using Type A to mini B cable. • V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V **Controller selection P, PI, PD, PID with slide switch** Parameter settings: Integral Time Ti (0.5-25Sec), Derivative Time Td (0-2Sec), Proportional Band Pb (5-200%), Set point (-9V- +9V) **Potentiometric error detection cum magnetic amplifier interface panel** Onboard Transformer - 2Nos. I) P: 0-230Vac S1 : 0 - 24Vac / 50mA, S2 : 0 - 6Vac / 500mA

		II) P: 0-230Vac S1 : 24 - 0 - 24 / 50mA • 3600 servo pots / 10K - 2Nos. • Facility to study error under AC supply (24-0-24) as well as DC supply (+12) application. **Magnetic Amplifier** **Electrical:**Magnetic Amplifier 2 Nos. table top units with Bias & Error winding (12V/500mA each) & Load winding (6VAC/500mA) and loading resistor 10E/5W. Sensor Loading resistor 10 ohm / 5W. **List of Expts**. • Can draw characteristic curve series /parallel mode of connection in standalone mode. • When used with servo position control, it drives control winding of AC servo through PMP using control transformer O/P
5	PC-based analog and digital motor control teaching set	**Salient Features:**Should have facility to work with Analog as well as Digital PID. Should have facility to monitor behavior of the PID output & process variable on PC screen. User settable PID controller parameters for P, PI, PD & PID operations. Should have facility of graph printing for laboratory journal entries. Electronic desk should carry useful experimental resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels. Connection through sturdy 4mm Banana sockets & Patch cords. Set of Students workbook & Instructor's Guide should be provided. PC is not in scope of supply but P4/XP with parallel port/ USB port needed. **Basic Resources on Electronic desk:**· DC supply +/- 12V,500mA.· 1ϕ sine reference for cosine firing 30Vpp max.· 17Vdc 500mA unregulated for driving pulse transformer**Display:**A) DPM – 2nos.a) For temp upto 100ºC & intensity in Lux (2000), b) For temp upto 500ºCB) AnalogMeter – 2nos.a) Center zero for display of process error (+9V), b) For MV/SP (0-2.5V)**Operating voltage:** selectable 220-240Vac +10% 50Hz **Operating modes:** Online monitoring / Data acquisition / PID Software should be provided.Simulator Mode, b) Process Monitoring Mode, c) PID controller Mode **Built in function generator:** O/p waveform selectable sine, triangular & square, O/p freq. range from 0.016Hz to 166Hz, 4 steps & frequency control pot, Variable amplitude using potentiometer from ±9V max. **Computer Interface Adapter / CIA** • Optoisolated Adaptor to prevent damage to PC parallel port/ USB port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channe• : o/p 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max • USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 Pin D shell using Type A to mini B cable. • V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V **Controller selection P, PI, PD, PID with slide switch** Parameter settings: Integral Time Ti (0.5-25Sec), Derivative Time Td (0-2Sec), Proportional Band Pb (5-200%), Set point (-9V- +9V) **Servo Interface panel** Control Interface circuit for AC & DC servo motor, signal

		conditioning circuit for speed sensor to O/P 0 - 2.5VDC (2500RPM) with speed direction. Level shifter 0 - 2.5V to ± 9V (2nos). Relay control characteristics :Hystersis, Dead band & Relay control circuit (2term & 3 term), process block for 2Nos. of 1st order lag / integral + transport lag, error and gain block for process simulation. Phase plane analysis by display of X & X dotShould have following real life process **DC servo position Control** PMDC motor 12Vdc, 40W, ND RPM 2000RPM with gear box (Ratio 30:1) Loading:. Servo amplifier with built in 12V / 3A Power Supply. Sensor: Photo reflective speed sensor with dir detects using 2 nos. of photodiodes. Servo pot as position feedback, position, speed, cascade control. **List of Experiments** · PID tunning by Ziegler Nichols Motor Process parameter study torque speed (optional) Dynamics measurements & transfer function determination. □ Close loop position control using 2/3 step controller. □ Close loop using 2/3 step controller with simulated processes. □ Open loop speed control of DC servo motor process III. □ Speed/Velocity control of DC motor □ Close loop control with analog pid □ Close loop control with digital PID □ Position control of DC motor □ Cascade control of speed & position feedback
6	PID Controller	**Salient Features:**Should have facility to work with Analog as well as Digital PID. Should have facility to monitor behavior of the PID output & process variable on PC screen. User settable PID controller parameters for P, PI, PD & PID operations. Should have facility of graph printing for laboratory journal entries. Electronic desk should carry useful experimental resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels. Connection through sturdy 4mm Banana sockets & Patch cords. Set of Students workbook & Instructor's Guide should be provided. PC is not in scope of supply but P4/XP with parallel port/ USB port needed. **Basic Resources on Electronic desk:**· DC supply +/- 12V,500mA.· 1ϕ □sine reference for cosine firing 30Vpp max.· 17Vdc 500mA unregulated for driving pulse transformer**Display:**A) DPM – 2nos.a) For temp upto 100ºC & intensity in Lux (2000), b) For temp upto 500ºCB) AnalogMeter – 2nos.a) Center zero for display of process error (+9V), b) For MV/SP (0-2.5V)**Operating voltage:** selectable 220-240Vac +10% 50Hz **Operating modes:** Online monitoring / Data acquisition / PID Software should be provided.Simulator Mode, b) Process Monitoring Mode, c) PID controller Mode **Built in function generator:** O/p waveform selectable sine, triangular & square, O/p freq. range from 0.016Hz to 166Hz, 4 steps & frequency control pot, Variable amplitude using potentiometer from ±9V max. **Computer Interface Adapter / CIA** • Optoisolated Adaptor to prevent damage to PC parallel port/ USB port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. 4 ADC channels : 0 to 2.5V full scale.

		1 DAC channe• : o/p 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max • USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 Pin D shell using Type A to mini B cable. • V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V **Controller selection P, PI, PD, PID with slide switch** Parameter settings: Integral Time Ti (0.5-25Sec), Derivative Time Td (0-2Sec), Proportional Band Pb (5-200%), Set point (-9V- +9V) **Process Simulator Panel**[Provided with 49 banana tags] □ Functional blocks for Lag (3 No.), Integrator (3 No.), Transport Lag (1 No.), Summer (2 No.), Gain (1 No.), Inverter (2 No.) for constructing simulated Type 0,1,2,3 & 1st, 2nd, 3rd Order processes to work under PID. □ Experiments with Lead / Lag / Lead - Lag compensators to control behaviour of matching processes using above function blocks. □ Open loop & close loop response of processes under different P, PI, PID - Analog or Digital controllers. Experimental varification of PID Controller settings (Pb, Ti, Td) □ Auto Tuning explained using Ziegler Nicolas I & II. □ Fast (10mS) & slow (1sec) mode selection for all processes to observe response on either CRO or PC using CIA. □ Drawing Bode plot &Nyquist plots, transfer function determination
7	Potentiometers as an Error Detector	**Salient Features:**Should have facility to work with Analog as well as Digital PID. Should have facility to monitor behavior of the PID output & process variable on PC screen. User settable PID controller parameters for P, PI, PD & PID operations. Should have facility of graph printing for laboratory journal entries. Electronic desk should carry useful experimental resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels. Connection through sturdy 4mm Banana sockets & Patch cords. Set of Students workbook & Instructor's Guide should be provided. PC is not in scope of supply but P4/XP with parallel port/ USB port needed. **Basic Resources on Electronic desk:**· DC supply +/- 12V,500mA.· 1ϕ □sine reference for cosine firing 30Vpp max.· 17Vdc 500mA unregulated for driving pulse transformer**Display:**A) DPM – 2nos.a) For temp upto 100ºC & intensity in Lux (2000), b) For temp upto 500ºCB) AnalogMeter – 2nos.a) Center zero for display of process error (+9V), b) For MV/SP (0-2.5V)**Operating voltage:** selectable 220-240Vac +10% 50Hz **Operating modes:** Online monitoring / Data acquisition / PID Software should be provided.Simulator Mode, b) Process Monitoring Mode, c) PID controller Mode **Built in function generator:** O/p waveform selectable sine, triangular & square, O/p freq. range from 0.016Hz to 166Hz, 4 steps & frequency control pot, Variable amplitude using potentiometer from ±9V max. **Computer Interface Adapter / CIA** • Optoisolated Adaptor to prevent damage to PC parallel port/ USB port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channe• : o/p 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max • USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed

		in 25 Pin D shell using Type A to mini B cable. • V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V **Controller selection P, PI, PD, PID with slide switch** Parameter settings: Integral Time Ti (0.5-25Sec), Derivative Time Td (0-2Sec), Proportional Band Pb (5-200%), Set point (-9V- +9V).**Potentiometric error detection cum magnetic amplifier interface panel** Onboard Transformer - 2Nos.I) P: 0-230Vac S1 : 0 - 24Vac / 50mA,S2 : 0 - 6Vac / 500mA II) P: 0-230Vac S1 : 24 - 0 - 24 / 50mA • 3600 servo pots / 10K - 2Nos. • Facility to study error under AC supply (24-0-24) as well as DC supply (+12) application.
8	Speed Control of AC Motor Using TRIAC	Triac lamp dimmer,AC fan regulator, SCR/DIAC operated light sensitive switch using LDR, SCR/DIAC operated temperature sensitive switch using thermistor, UJT relaxation oscillator, Half and full wave (Phase shift controlled) rectifier using SCR, Timer using SCR &UJT.standalone panel with built in Power supply **Fractional HP Universal** AC/DC motor 230V AC/1/12HP, Spring balance loaded chasis mounted for converter as well as controller application
9	Speed Control of Universal Motor Using SCR	•Should have Master unit carrying useful experiment resources like line Synchronised firing circuits, Power supplies, lamp load, RLC loads, Battery charging supply etc. while the central slot will hold replaceable experiment panels. •Each multi experiment panel must be secured in an ABS molded plastic sturdy enclosure, and must have colorful screw less overlay showing circuit & Connection through Sturdy 4mm Banana Sockets & Patch Chords. **Master Unit :** Should have Built in power supply **DC supply :** +/- 12V, 500mA, Unreg Power supply 17V / 750mA, Regulated 13.5V/3A O/P mustbe provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc. Isolated DC supply +12V/ 300mA with isolated common. On board Inverter transformer of Primary : 230V &Secondaries 12-11-0-11-12/3A On board Lamp load of 15W (100W) should be provided. **AC supply :**230V AC line voltage must be made available on two banana 4mm sockets. **LSPT Panel consisting of** Must have Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector. **R-L-C Load Panel** Must have Load resistor of 10W / 40W --- 1no. Must have Centre tapped 3A choke 4mH/ 16mH each ----2nos.

		Must have Commutation capacitors of 10mF/100V -------4nos. Must have AC Paper capacitor of 4mF/440V ---1no. **CON / INV Panel** **SCR Converters must be** Provided with sturdy 800V/12A SCRs (4nos) with uncommitted snubbers, 6A diodes (2nos) commutation switch, 47m/450V cap, Ramp cosine firing circuit. However actual working currents are limited to 3A (max) for safety. Must have facility to study Advanced firing Schemes, SCR forced Commutation Techniques, SCR based Inverters ,Cycloconverter, SCR based Chopper. **Fractional HP Universal** AC/DC motor 230V AC/1/12HP, Spring balance loaded chasis mounted for converter as well as controller application For Demonstration various experiments in power Electronics need Power Scope attachment for your Lab dual trace CRO to high voltage off ground wave forms CRO dual channel
10	Study of Second Order Networks	**Salient Features:**Should have facility to work with Analog as well as Digital PID. Should have facility to monitor behavior of the PID output & process variable on PC screen. User settable PID controller parameters for P, PI, PD & PID operations. Should have facility of graph printing for laboratory journal entries. Electronic desk should carry useful experimental resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels. Connection through sturdy 4mm Banana sockets & Patch cords. Set of Students workbook & Instructor's Guide should be provided. PC is not in scope of supply but P4/XP with parallel port/ USB port needed. **Basic Resources on Electronic desk:**· DC supply +/- 12V,500mA.· 1ϕ sine reference for cosine firing 30Vpp max.· 17Vdc 500mA unregulated for driving pulse transformer**Display:**A) DPM – 2nos.a) For temp upto 100ºC & intensity in Lux (2000), b) For temp upto 500ºCB) AnalogMeter – 2nos.a) Center zero for display of process error (+9V), b) For MV/SP (0-2.5V)**Operating voltage:**selectable 220-240Vac +10% 50Hz **Operating modes:** Online monitoring / Data acquisition / PID Software should be provided.Simulator Mode, b) Process Monitoring Mode, c) PID controller Mode **Built in function generator:** O/p waveform selectable sine, triangular & square, O/p freq. range from 0.016Hz to 166Hz, 4 steps & frequency control pot, Variable amplitude using potentiometer from ±9V max. **Computer Interface Adapter / CIA** • Optoisolated Adaptor to prevent damage to PC parallel port/ USB port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channe• : o/p 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max • USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 Pin D shell using Type A to mini B cable. • V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V **Controller selection P, PI, PD, PID with slide switch** Parameter settings: Integral Time Ti (0.5-25Sec), Derivative Time Td (0-2Sec), Proportional Band Pb (5-200%), Set point (-9V- +9V)

		Process Simulator Panel[Provided with 49 banana tags] • Functional blocks for Lag (3 No.), Integrator (3 No.), Transport Lag (1 No.), Summer (2 No.), Gain (1 No.), Inverter (2 No.) for constructing simulated Type 0,1,2,3 & 1st, 2nd, 3rd Order processes to work under PID. • Experiments with Lead / Lag / Lead - Lag compensators to control behaviour of matching processes using above function blocks. • Open loop & close loop response of processes under different P, PI, PID - Analog or Digital controllers. Experimental varification of PID Controller settings (Pb, Ti, Td) • Auto Tuning explained using Ziegler Nicolas I & II. • Fast (10mS) & slow (1sec) mode selection for all processes to observe response on either CRO or PC using CIA. • Drawing Bode plot &Nyquist plots, transfer function determination.
11	Study of Servo Motor	**Salient Features:**Should have facility to work with Analog as well as Digital PID. Should have facility to monitor behavior of the PID output & process variable on PC screen. User settable PID controller parameters for P, PI, PD & PID operations. Should have facility of graph printing for laboratory journal entries. Electronic desk should carry useful experimental resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels. Connection through sturdy 4mm Banana sockets & Patch cords. Set of Students workbook & Instructor's Guide should be provided. PC is not in scope of supply but P4/XP with parallel port/ USB port needed. **Basic Resources on Electronic desk:**· DC supply +/- 12V,500mA.· 1ϕ sine reference for cosine firing 30Vpp max.· 17Vdc 500mA unregulated for driving pulse transformer**Display:**A) DPM – 2nos.a) For temp upto 100ºC & intensity in Lux (2000), b) For temp upto 500ºCB) AnalogMeter – 2nos.a) Center zero for display of process error (+9V), b) For MV/SP (0-2.5V)**Operating voltage:** selectable 220-240Vac +10% 50Hz **Operating modes:** Online monitoring / Data acquisition / PID Software should be provided.Simulator Mode, b) Process Monitoring Mode, c) PID controller Mode **Built in function generator:** O/p waveform selectable sine, triangular & square, O/p freq. range from 0.016Hz to 166Hz, 4 steps & frequency control pot, Variable amplitude using potentiometer from ±9V max. **Computer Interface Adapter / CIA** • Optoisolated Adaptor to prevent damage to PC parallel port/ USB port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channe• : o/p 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max • USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 Pin D shell using Type A to mini B cable. • V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V **Controller selection P, PI, PD, PID with slide switch** Parameter settings: Integral Time Ti (0.5-25Sec), Derivative Time Td (0-2Sec), Proportional Band Pb (5-200%), Set point (-9V- +9V) **Stepper Motor demonstrator experiment panel** Direction, speed, auto, manual operations of Stepper Motor, Position control by step

		operation, Position control by continuous operation, Angle control by step operation, Speed control by control switch, Angle control by software, Dynamic current / torque characteristics. Closed loop experiment with servo pot for PID experiments, V to F function block. **i) Stepper Motor** Table Top assembly / accessories Stepper (3kgcm/12V) Coupled to servo / accessories pot. Sensor feedback Servo pot as position **List of Experiments** 1) Study of Stepper motor behaviour under open loop / closed loop 2) Open loop stepper control under Manual/Auto modes 3) Closed loop stepper motor control using PID Controller
12	Synchro control transformer	**Table Top:** • Operated from 230Vac+10% 50Hz • Synchro transmitter / Receiver pair • Rotor 1 phase 115 Vac/120mA • Stator 3 Ph.90VAC-9 pin D (MM) connector (optional) to interface with panel **Sensor :** 1 No. servo pot (optional) for position feedback (0-2.5V) of command synchro for PC interface acts as electrical command station (SP) for process VI if interfaced **List of expt.** • Study of working principle of synchro transmitter and receiver in standalone mode. • When used with AC Servo position control (Process-VI), it works as servo position command station through PMP panel.
13	Temperature Control System	**Salient Features:**Should have facility to work with Analog as well as Digital PID. Should have facility to monitor behavior of the PID output & process variable on PC screen. User settable PID controller parameters for P, PI, PD & PID operations. Should have facility of graph printing for laboratory journal entries. Electronic desk should carry useful experimental resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels. Connection through sturdy 4mm Banana sockets & Patch cords. Set of Students workbook & Instructor's Guide should be provided. PC is not in scope of supply but P4/XP with parallel port/ USB port/ USB needed. **Basic Resources on Electronic desk:**· DC supply +/- 12V,500mA.· 1ϕ sine reference for cosine firing 30Vpp max.· 17Vdc 500mA unregulated for driving pulse transformer**Display:**A) DPM – 2nos.a) For temp upto 100ºC & intensity in Lux (2000), b) For temp upto 500ºCB) AnalogMeter – 2nos.a) Center zero for display of process error (+9V), b) For MV/SP (0-2.5V)**Operating voltage:** selectable 220-240Vac +10% 50Hz **Operating modes:** Online monitoring / Data acquisition / PID Software should be provided.Simulator Mode, b) Process Monitoring Mode, c) PID controller Mode **Built in function generator:** O/p waveform selectable sine, triangular & square, O/p freq. range from 0.016Hz to 166Hz, 4 steps & frequency control pot, Variable amplitude using potentiometer from ±9V max. **Computer Interface Adapter / CIA** • Optoisolated Adaptor to prevent damage to PC parallel port/ USB port (25 pin LPT) due to

		wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channe• : o/p 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max • USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 Pin D shell using Type A to mini B cable. • V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V **Controller selection P, PI, PD, PID with slide switch** Parameter settings: Integral Time Ti (0.5-25Sec), Derivative Time Td (0-2Sec), Proportional Band Pb (5-200%), Set point (-9V- +9V) **A) Thyristor Actuator panel** Thyristor bridge based 0-200V/3A cosine firing circuit. Supports signal conditioning of RTD (PT100), Thermocouple K type & Photodiode to output 0-2.5Vdc (FS). Should facilitates closed loop control experiments based on temperature, light intensity, speed measurement using built in P/PI controller as well as external Analog / Digital PID controller. Should have following real life process **i) Process Temp/Light** Process box contains 3 high wattage (60W) bulbs under aluminum plate heater. Built in fan, lamp as disturbance generator. Sensor RTD for temperature control upto 100 degree C with built in CAL facility, Photodiode for light intensity control upto 2000lux. **List of Experiments :** PID tunning by Ziegler - Nichols Transfer function determination Operation under various P/I/D options. Open loop response to step input (transfer function determination) Close loop control with Analog PID Close loop control with Digital PID Close loop control with built in Proportional controller / lag compensator (PI controller)PID control with PWM O/P

FORMAT FOR QUOTATION SUBMISSION

(In letterhead of the supplier with seal)

Date: _____

To:

_____

_____

Sl. No.	Description of goods (with full Specifications)	Qty.	Unit	Quoted Unit rate in Rs. (Including Ex Factory price, excise duty, packing and forwarding, transportation, insurance, other local costs incidental to delivery and warranty/ guaranty commitments)	Total Price (A)	Sales tax and other taxes payable	
						In %	In figures (B)
Total Cost							

Gross Total Cost (A+B): Rs. _____

We agree to supply the above goods in accordance with the technical specifications for a total contract price of Rs. ———————— (Amount in figures) (Rupees ————————amount in words) within the period specified in the Invitation for Quotations.

We confirm that the normal commercial warranty/ guarantee of ——————— months shall apply to the offered items and we also confirm to agree with terms and conditions as mentioned in the Invitation Letter.

We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in bribery.

Signature of Supplier

Name: _____

Address: _____

Contact No: _____