

INDIRA GANDHI ENGINEERING COLLEGE SAGAR (M.P.) 470021
(DECLARED AUTONOMOUS BY M.P. GOVT.)

NO/IGEC/Electronic/2015-16/

Sagar, Date



Tel.No.07582-263844,263826

Visit us: www.igecsagar.ac.in

e-mail: dr.principalgec@rediffmail.com

“TENDER NOTICE No.ELECTRONICS/01/15-16”

Sealed tender are invited from the manufactures/authorized dealers/distributers on their Letter head for supply of Equipments in various laboratories of EC Engineering Department of this institution.

1. PCB FABRICATION LAB	EMD Rs 8,500/-	Approx Cost Rs 4.18 Lac
2. CIRCUIT AND DIGITAL LAB	EMD Rs 9,000/-	Approx Cost Rs 4.41 Lac
2. ANTENNA LAB	EMD Rs 5,500/-	Approx Cost Rs 2.75 Lac
3. COMMUNICATION LAB	EMD Rs 17,500/-	Approx Cost Rs 8.60 Lac

Details specification of all the items along with the terms and conditions are provided in the tender document. Tender can be purchased from the office of the Principal Indira Gandhi Engineering College , Sagar (M.P.) on payment Rs 1000/- in cash or in the form of DD in any working day between 9.00 am to 2.00 pm from 19.02.2016 Tender Document by post will not entertained.

Important dates of the Tender are as follows:-

Last date and time of selling the Tender form	14/03/2016 up to 2:00 pm
Last date and time of receiving the Tender	15/03/2016 up to 2:00 pm
Date and time of opening the Tender	16/03/2016 up to 12:30 pm

Tender will be opened in the institute in the presence of such Tenderers or their representative who may like to be present. Information regarding Tenders can be seen from the institute Website www.igecsagar.ac.in

SECRETARY/PRINCIPAL

कार्यालय, प्राचार्य इंदिरा गांधी इंजीनियरिंग महाविद्यालय सागर(म0प्र0)
(शासन द्वारा स्वशासी घोषित)

क्रमांक / आई.जी.ई.सी. / ई.सी. / 2016 /

सागर, दिनांक



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निविदा आमंत्रण सूचना संख्या / इलैक्ट्रानिक्स / 01 / 15-16

निविदा आमंत्रण सूचना संख्या / इलैक्ट्रानिक्स / 01 / 15-16 इस संस्था के इलैक्ट्रानिक्स विभाग की विभिन्न प्रयोगशालाओ के क्रय करने हेतु अधिकृत डीलरो / डिस्ट्रीब्यूटरो से उनके लेटर हेड पर निविदा आमंत्रित की जाती है।

- | | | | |
|----|-------------------------|------------------------|----------------------------|
| 1. | पी.सी.बी फ़ैबरीकेशन लैब | अमानत राशि रु. 8500 /- | अनुमानित राशि रु. 4.18 लाख |
| 2. | सर्किट एवं डिजिटल लैब | अमानत राशि रु. 9000 /- | अनुमानित राशि रु. 4.41 लाख |
| 3. | एन्टीना लैब | अमानत राशि रु. 5500 /- | अनुमानित राशि रु. 2.75 लाख |
| 4. | कम्प्यूनीकेशन लैब | अमानत राशि रु.17500 /- | अनुमानित राशि रु. 8.60 लाख |

सभी आईटमो के विसतृत स्पेसीफिकेशन निविदा प्रपत्र मे सभी शर्तो के साथ दिये गये है। कार्यालय प्राचार्य इंदिरा गांधी इंजीनियरिंग महाविद्यालय से नगद रु.1000 /- अंकन एक हजार मात्र अथवा बैंक ड्राफ्ट देय प्राचार्य इंदिरा गांधी इंजीनियरिंग महाविद्यालय सागर के कार्यालय समय मे दिनांक 19/02/2016 समय 09.00 बजे से 2:00 बजे दोपहर तक निविदा प्रपत्र क्रय किये जा सकते है। डाक द्वारा निविदा प्रपत्र नही भेजे जावेगे।

निविदा हेतु महत्वपूर्ण तारीखे:-

- | | |
|--|------------------------------------|
| 1. निविदा प्रपत्र क्रय करने की अंतिम तारीख व समय | 14 / 03 / 2016 समय 2:00 बजे दोपहर |
| 2. निविदा प्रपत्र जमा करने की अंतिम तारीख व समय | 15 / 03 / 2016 समय 2:00 बजे दोपहर |
| 3. निविदा खुलने की तारीख व समय | 16 / 03 / 2016 समय 12:30 बजे दोपहर |

निविदा संस्था मे निविदाकारो अथवा उनके प्रतिनिधियो जो उपस्थित रहने के इच्छुक हो, के सामने खोली जावेंगी। निविदा से संबंधित जानकारी महाविद्यालय की वेबसाइट www.igecsagar.ac.in पर देख सकते है।

सचिव / प्राचार्य

**OFFICE OF THE PRINCIPAL
INDIRA GANDHI ENGINEERING COLLEGE BAHERIA SAGAR M.P.
(Declared autonomous by Govt. of M. P.)**



Tel.No.07582-263826,263844
Visit us: www.igecsagar.ac.in
E-mail: dr.principalgec@rediffmail.com

Tender No. EC/01/15-16

Sagar, Dated- / / 2016

Tender

In

The Department of Electronics & Communication Engineering 2015-16

The 16 March 2016 at 2:00 pm in the Office of The Principal,
I.G.E.C. Sagar- M.P.

TOTAL PAGE 21

Price Rs. 1000/-only by Cash / Bank Draft, in favour of Principal IGEC, Sagar

INDIRA GANDHI ENGINEERING COLLEGE SAGAR M.P.

(declared autonomous by the Govt. of M.P.)

S/No./IGEC/ EC / 2015-16/ / /

Sagar Dated



Subject:- 1- Terms & Conditions .
2 - Detailed Specifications.

Last date and time of selling tender form	14/03/16 at 2:00 P.M.
Last date and time of receiving sealed tenders	15/03/16 at 2:00 P.M.
Date and time of opening tenders :	17/03/16 at 12:30 P.M.

I TERMS AND CONDITIONS:

1. The tender form is non transferable.
2. Tender received after due date and time will not be accepted in any case.
3. (a) Only actual manufacturers or their authorized suppliers/dealers/stockiest/agents may submit their tender. A certificate to this effect should be enclosed along with the tender.
(b) The tender must be sent in firm's own letterhead, along with the terms and conditions of supply.
4. Tender received with overwriting or filled with pencil will not be accepted.
5. Representatives of the firms are advised to be present in this institution at the time of opening the tender for demonstrating the silent features of the equipments quoted by them through multimedia presentation failing which the tender may not be considered.
6. The tenders are required to mention the salient features of the services provided after the sale of the item.

II SPECIFICATIONS

- (i) Complete technical specifications must be furnished in the tender. Make of the equipments offered in the tender must be mentioned and duly supported with the original printed catalogues/leaf-lets/ photographs of the equipments without which, the offer will be rejected.
- (ii) For the proprietary items the relevant certificate must be enclosed.
- (iii) In case any of the equipment is available on DGS & D/MPLUN rate contract and offered in the tender, the tender, the supplier should furnish a copy of the rate contract.
- (iv) If any of the equipment of required specification is not available, then nearest higher specification to the required specification may be considered.
- (v) Printed terms & conditions on the letterhead will not be binding unless separately mentioned.
- (vi) Equipment & machinery calibrated in MKS/SI system only be quoted
- (vii) The better or higher specifications than the required specification will be considered.

III RATES AND TAXES

- (a) The rates must be quoted F.O.R. Indira Gandhi Engineering College, Sagar (M.P.) 470021.
- (b) If the rates are quoted excluding excise duty, then the firm must specify clearly the name of equipment on which excise duty is payable extra and rate Applicable.

- (c) Other taxes and duties, if payable extra, should be clearly stated in the offer failing which the rate quoted will be considered inclusive of all taxes and duties and no claim for the same will be entertained.
- (d) The quoted rates must be inclusive of installation/demonstration of the equipment/ machines in perfect working condition after delivery. No extra payment will be made for the installation and/ or demonstration.

IV EARNEST MONEY

- (a) The tenderer is required to furnish earnest money deposit laboratory wise as follows:

For part 1. PCB FABRICATION LAB	EMD Rs 8,500/-	Approx Cost Rs 4.18 Lac
Part 2. CIRCUIT AND DIGITAL LAB	EMD Rs 9,000/-	Approx Cost Rs 4.41 Lac
Part 2. ANTENNA LAB	EMD Rs 5,500/-	Approx Cost Rs 2.75 Lac
Part 3. COMMUNICATION LAB	EMD Rs 17,500/-	Approx Cost Rs 8.60 Lac

- (b) Earnest money should be sent through Bank Draft only drawn in favor of Principal, I.G. Engineering College Sagar (M.P.) payable at Sagar. Earnest Money in the forms, other than the Bank Draft (e.g. Cheque, FDR, IPO etc.) will not be accepted.
- (c) The earnest money of previous tenders, not refunded to the firm, will not be adjusted in this tender.
- (d) The SSI firms registered with the industry Department of Govt. of MP. only or Govt. of India undertaking firms are exempted to furnish earnest money. The said firms will be required to enclose a certificate to this effect. The SSI firms registered in other states of the country will not be able to avail such exemption

V CONDITIONS TO FORFEIT EARNEST MONEY

The entire amount of earnest money or security deposit will be forfeited due to any one of the following :

- (a) The supplier either expresses his inability or dose not execute the order for quoted items mentioned in the tender.
- (b) If the complete equipment is not supplied with in the delivery period mentioned in the order or within the extended period from time to time.
- (c) If the supplier executes only part of the order.
- (d) In case of any default in the execution of order the undersigned will have discretion to forfeit the entire amount of earnest money.
- (e) If defects of any kind or variation from specifications are reported to the supplier, the Supplier will have to rectify the defects or replace the equipment/machine free of all charges with in 30 days from the date of report, failing which the items will be returned to the supplier at his own risk and entire amount of earnest money will forfeited.
- (f) If supplier fails to fulfill the terms and conditions of the tender partly or fully.

VI Payment :

Payment in full will be made after physical installation of the equipment in perfect working condition and complete demonstration in the institute No part payment for the defective/ incomplete equipment will be made. If the undersigned feels that the equipment supplied is grossly defective and cannot be repaired or the supplied material/equipment is of substandard quality; the supplied equipment will be rejected & returned to the supplier at his risk. No payment or part their of will be made to this effect to the supplier and the order will be cancelled.

VII WARRANTY: 2YEARS Warranty period will start from the date of installation and satisfactory commissioning.

VIII OTHER CONDITIONS

Tender will only be considered if following conditions have been mentioned in the tender, otherwise the tender will be rejected

- (a) Validity period: Validity period must be at least 6 months from the date of opening of the tender.
- (b) Delivery period: The delivery period for supply of equipment should not be more than 30 days (may be extended on specific request with the discretion of the undersigned). However ex-stock offer will be preferred.
- (c) Any decrease in the taxes at the time of supply if occurs, then the benefit of the same should go to the Intuition.
- (d) The tenderer should undertake to repair or replace free of cost/ charges the defective parts due to faulty design and/ or bad workmanship during the period of one year from the date of installation of the equipment in perfect working condition and demonstration at the Institute.
- (e) The undersigned does not pledge him to accept the lowest or any tender and also reserves the right of rejecting all or any of the tender without giving any reason for the same.
- (f) No request for the supply of any details in respect of tender or the comparative chart or any other enquiry in respect of the tender already received in this office, will be entertained in any case.
- (g) All disputes with regard to the contracts for the purchase of materials etc. will be subject to the jurisdiction of courts at Sagar (M.P.) only.

IX Sealed tender should be submitted in 3 envelopes as mentioned below:

Envelop A Pre Bid Qualification : Envelope comprising of EMD /Manufacturer/Dealership certificate, CT/ST, PAN/TIN No.

Envelop B Technical Qualification:- Envelope comprising technical specification Brochures of equipment /printed catalogue / leaflets.

Envelope C Financial Bid:- Envelope comprising rates of equipments/machines.

All the three envelopes (A, B and C) should be sealed separately and then enclosed in another outer envelope D addressed to the Principal I.G. Engineering College, Baheria, Sagar (M.P.) 470004.

Note:- Envelope C (Financial Bid) will not be opened of the suppliers, who does not qualify for Envelop A pre bid and Envelop B Technical Qualification.

The envelope D must be super scribed as Tendered Documents Against Tender

Notice No.-----

Above procedure of tender in point VIII must be strictly followed otherwise the tender will be rejected.

Technical qualification envelope will be opened only for those offers that clear pre bid qualification and financial bid envelope will be opened only for those offers that qualify in technical qualification.

Enclosures: detailed specifications of the equipments.

**Principal,
I.G. Engineering College
Sagar(M.P.)**

Sr. No.	Name of Item	Qty.
1.	PCB Fabrication Lab	
i)	PCB Artwork Film maker The Proto-Contact is a tabletop unit, which serves as a Negative making contact printer as well as an illuminated Artwork table for Circuit Artwork taping and Inspection of Films and Negatives. Avoiding expensive cameras, the user can directly make Negatives from 1 X scale artworks. It has a working area of 300 mm X 250 mm (12" X 10") with diffused light, and a push button operated exposure. The overall dimensions are: 380 mmX230mmX330 mm. Electrical Power: 230V/50Hz, 5A Socket required	1
ii)	PCB Curing machine (Oven) Tabletop unit for curing of liquid photo resist. Timer controlled heating system allows fast and efficient PCB curing. PCB Size: 250mm x 300mm (10' x12"). Heating: Heaters with thermostat controls. Timers: Preset timer Electrical Power: 230V 150Hz. 15A Socket required	1
iii)	PHOTO RESIST DIP COATING MACHINE The Machine is tabletop and compact. A single Operation unit designed for coating of laminates with Photo resists. The machine ensures uniform controlled thickness of Photo resist on copper clad * Max Board size - 250mm x 300mm (10 x 12") * Rectangular Tank Capacity: 2 liters. * Dips one PCB at a Time * Electrical Power: 230V/50Hz, 5A Socket required	1
iv)	DOUBLE SIDED U.V. EPOSURE UNIT A tabletop double sided exposing unit for high resolution exposure of PCBs. Maximum Size: 300mm x 255mm (12" x 10") UV Tubes: 2 x 4 (8 Watts) actinic tubes with Single/double side option Chokes: Electronic Type Timer: 0 - 10 minutes Electrical Power: 230 V - 50Hz, 5A Socket required	1
v)	PCB ETCHING MACHINE For fast single and double sided PCB etching. Useful etching area: 250mm x 300mm (10'x12"). Tank Capacity : 20 Litters. Includes a heater and airflow compressor. All construction materials are corrosion free. Heater: Titanium - non corrosive with thermostat control Timer: 0 - 4.0 minutes Electrical Power : 230V/50Hz, 5A Socket required	1
vi)	PCB DRILLING MACHINE A compact tabletop High speed PCB drilling machine with a Quick Change Chuck <ul style="list-style-type: none"> • Drill holding by precision chuck with lapped jaws • Mains operated DC motor - Direct drive (no belt and pulley) • 3 Step Speed Control • Illumination of Work Area Technical Data Motor Speed: unto 20,000 R.P.M. Range: 0.6 to 3.0 mm	1

	Base: Metal Working Area : 280 mm X 170 mm Electrical Power: 230V/50Hz, 5A Socket required	
vii)	PCB SHEARING MACHINE- Bench top Guillotine type shearing machine to cut PCB's and Laminates. Compact structure with central handle allows ease of cutting. Width: 300mm (12") Size: 400mm X 350mm	1
viii)	Roller Tinning Machine The Single structure tabletop unit for Tin/Solder coating of PCB's. A hand operated flywheel allows easy coating of boards. Maximum PCB Width: 250mm (10%) Solder Bath Capacity: 5Kgs Roller Gap Adjustment: Provided with 2 wheel Heaters: 2x500watts Roller: Silicon Coated Roller Revolution: Gear Flywheel Drive Bearings: Teflon Chemical for Roller Tinning Machine 1) Solder 63:37- 5 Kgs ,2) Roll Salt- 2 Kgs 3) Flow Cost- Litter	1
ix)	DYE/DEVELOPER (2 in 1 Unit) A unique tabletop unit, which gives you the convenience of dying and Developing both in 1 machine. A Diaphragm pump agitates the developing solution chamber. A separate Dye chamber is also provided. Technical Specification: Max. PCB Size: 250mm x 300mm (10" x 12") Tank Capacity: 2Ltr. for Developer solution 2Ltr. for Dye solution. Air pump: Diaphragm type compressor pump Mechanical Timer: 0-4 min. to operate air pump	1
x)	PCB Design Facility 1) PCB Drafting Aids Kit Tapes, Pad and other materials for making PCB Artworks for making PCBs 2) ARTWORK TABLE Tabletop Artwork and PCB inspection table with bottom illumination and diffused light. Area for work: 20% 24%	1
xi)	Board Preparation & Cleaning 1) Single Sided PCB Laminate Nos. 10 Paper Phenolic 300x 300mm(1 x 1 feet) II For Dark Room 1) Safe Lamp Unit 1 2) Lith Film 250 x 300mm(10 x 12") Nos. 10 3) Lith Film Developer A&B(5 Ltrs) Pkt. 1 4) Lith Film Fixer Bottle 1 5) Developing Trays Nos. 3 III For Photoresist Dip Coating Machine 1) Liquid Photoresist Liters 2 2) Photoresist Thinner Liter 1 3) Photoresist Developer Liters 5 4) Photoresist Dye Liters 5 5) Jars Nos. 2 IV For Etching Machine 1) Etching Crystals Kgs. 5 V For PCB Drilling Machine Drill Bits 1) 0.80mm Nos. 2	1

	2) 1.00mm Nos. 2 VI) PCB Holder No. 1	
2.	<p>Discrete Components Trainer</p> <p>Specification:-</p> <ul style="list-style-type: none"> • In-built DC Power Supply: $\mu 5$ V/ 500 mA, $\mu 12$V/500mA. • Inbuilt Variable DC Power Supply: 0 to +15V/500mA. • Inbuilt AC Power Supply: 0-9V/500mA. • Onboard 20 pin ZIF socket. • Onboard Ammeter(0-999mA) Onboard Voltmeter(0-20V) • Onboard Bread board. Onboard Diode Bank. • Onboard Resistor Bank: (100 , 1K, 2K, 5K, 10K, 47K,100K, 1M, 10M). • Onboard Electrostatic Capacitor Bank (22pf, 33pf, 0.001uf, 0.01uf, 0.1uf). • Onboard electrolytic Capacitor Bank: (1uF, 10uF,47uF,100uF,470uF). • Onboard Variable Resistor Bank: (1K, 10K, 100K). Onboard FET. • Onboard Inductor Bank. Onboard ICs: IC741, 555 Timer. • Onboard LDR ,Temperature Sensor, Relay. • Onboard SCR, MOSFET, IGBT, UJT,DIAC and TRIAC. • Onboard Transformer: 9-0-9VAC/50Hz. • Onboard NPN Transistor:- BC547. Onboard PNP Transistor · BC557. • Logic Level Indicators: 3 independent buffered logic level indicators for High / Low status. • Power ON switch with indicator and fuse for protection. • Power Requirement: 230VAC/50Hz μ10%. <p>Experiments can be performed:-</p> <ul style="list-style-type: none"> • Study of resistors, capacitors, inductors, potentiometers, output transformer, relay. • To study about V-I Characteristics of different types of Diodes. • Study and verify the basic theorems & laws such as resistors / capacitors / inductors in series / parallel and combinations. • Study of Ohm's laws. • Study of Kirchoff's voltage law and Kirchoff's current law • Study & verify the clipping, clamping and biased clippers. • Study of half wave, full wave & bridge rectifier circuits • Study and verify the voltage regulators circuits using zener diodes & transistors. • Study of Transistor (s) amplifiers (CB, CE & CC), Power amplifiers, Differential amplifiers, Feedback • amplifier current series and current shunt, RC phase shift oscillator. • Study of Op-Amp characteristics & its application such as open loop gain, output resistance, differential input resistance, voltage follower. • Study of Op-Amp as inverting and non-inverting amplifier and their frequency response. • Study of Op-Amp as adder, subtractor, differential amplifier, integrator and differential frequency response. • Study of slew rate, input offset voltage, input bias current, CMRR, common mode input resistance in Op-Amp. • Study of RLC series and parallel resonance circuits • Design and performance evaluation of FET amplifiers. • Study of SCR, IGBT, UJT, MOSFET, TRIAC, DIAC. • Study and design of Temperature Control Fan. 	10

	<ul style="list-style-type: none"> Study and design Automatic Light Control using LDR <p>Many other experiments are possible using the onboard components and Breadboard provided. (for use of external components)</p> <p>Accessories:- Power Cable · 1, Patch Cords · 8, DC Fan-1, User Manual · 1. , e-manual -1 CD.</p>	
3.	<p>Linear IC Trainer Specification:-</p> <ul style="list-style-type: none"> In-built DC Power Supply: $\mu 5$ V/ 500 mA, $\mu 12$V/500mA. Inbuilt Variable DC Power Supply: 0 to +15V/500mA. Inbuilt AC Power Supply: 0-9V/500mA. Onboard Ammeter(0-3A) Onboard Voltmeter(0-200V) Onboard Bread board. Onboard Diode Bank. Onboard Resistor Bank Onboard Capacitor Bank Onboard Variable Resistor Bank Onboard Inductor Bank Onboard NPN Transistor:- BC547. Onboard PNP Transistor · BC557. Logic Level Indicators: 4 independent buffered logic level indicators for High / Low status. Logic Input Switch: 4 good quality TTL based Input Logic Switch. Power ON : Power ON switch with indicator for mains on indication and fuse for protection. Power ON switch with indicator and fuse for protection. Power Requirement: 230VAC/50Hz $\mu 10$%. <p>On-board Linear ICs:-</p> <ul style="list-style-type: none"> High Speed Comparator IC· 710. Function Generator IC-566. Phase Lock Loop IC NE-565. Fixed Voltage Regulator: 7805,7905. Variable Voltage Regulator IC- 317,337 and 723. IC 555 Timer Optocoupler IC- MCT2E. <p>Experiments can be performed:-</p> <ul style="list-style-type: none"> Study of Inverting Amplifier. Study of Non inverting Amplifier. Study of Voltage Follower. Study of Integrator and its frequency response. Study of Differentiator and its frequency response. Study of Summing Amplifier. Study of Subtractor. Study of Current to Voltage Converter. Study of Low Pass Filter. Study of Negative and Positive Clamper. Study of Fixed Voltage Regulators. Design a Fixed +5V DC Supply using Voltage Regulator IC7805. Study of Variable Voltage Regulators. Design a Variable DC Supply using Voltage Regulator LM317. Study of Opto-coupler. To Study and design of Monostable Multivibrator using 555 Timer 	10

	<ul style="list-style-type: none"> To study and design of Astable Multivibrator using 555 Timer. To study and design of Bistable Multivibrator using 555 IC Timer. Design and performance evaluation of transistor amplifiers in CE, CB and CC configuration. To design and construct a shunt and series regulator and find line and load regulation. <p>Many other experiments are possible using the onboard components and Breadboard provided. (for use of external components)</p> <p>Accessories:- Power Cable · 1, Patch Cords · 8, User Manual · 1., e-manual-1CD.</p>	
4.	<p>Digital IC Trainer Specification:-</p> <ul style="list-style-type: none"> Fixed DC Power Supply: $\mu 5\text{ V} / 500\text{ mA}$, $\mu 12\text{V}/500\text{mA}$. Clock Generators: i) Fixed: a. 1Hz b. 10Hz. c. 100Hz (Simultaneous independent outputs). (TTL, 5V) ii) Variable: One low frequency variable clock generator. Manual Pulser: One independent bounce less manual Pulser (useful for freezing the action of each stage of the counter after every clock pulse). Logic Input Switches: 10 independent logic level inputs to select High / Low TTL levels, each with a LED to indicate high / low status and termination. Logic Level Indicators: 10 independent buffered logic level indicators for High / Low status Seven segment display with decoder IC: One BCD to Seven Segment Decoder/ Driver IC with terminations. Logic Probe given on board. Onboard Ammeter(0-3A) Onboard Voltmeter(0-200V). All logic gate operation given onboard with multi operations. ZIF socket : ICs up to 20 pin Universal ZIF Socket (without soldering) Power ON switch with indicator and fuse for protection. Power Requirement: 230VAC/50Hz μ 10%. <p>Digital ICs Mounted on Board:- Quad 2 -Input NAND Gate (7400) Quad 2 -Input NOR Gate (7402) Quad 2 -Input AND Gate (7408) Quad 2 -Input OR Gate (7432) Hex Inverters (7404) Dual 4-Input NAND Gate (7420) 4-Bit Magnitude Comparator (7485) Monostable Multivibrator (74121) Decade counter (7490) Dual 4-Input NOR Gate (7425) Dual 2 Ex OR Gate (7486) Dual JK Flip Flop (7476) 4-Bit R/L Shift Register (7495) Up/Down Binary Counter (74193) 4-Bit Binary Full Adder (7483) BCD to 7-Segment Decoder (7447) Synchronous Binary Counter (74163)</p> <p>Accessories:- Power Cable · 1, Patch Cords · 8, User Manual · 1. e-manual- 1CD.</p> <p>Experiments can be performed :-</p> <ul style="list-style-type: none"> Study of basic gates and verification of their truth tables (NOT, OR, AND, NOR, 	10

	<p>NAND, EX-OR, EX-NOR)</p> <ul style="list-style-type: none"> • Study and verifications of the laws of Boolean Algebra and De-Morgan's Theorems. • Study of important TTL terminologies. Verification of important TTL circuit parameters. • Construction and verification of various types of flip - flops using gates & IC's (RS, JK, D, T, M / S JK) • Construction and verification of various types of combinational circuits such as Half Adder, Full Adder, • Construction and verification of Half Subtractor, Full Subtractor • Construction and verification of Even / Odd Parity Checker • Construction and verification of Multiplexer, Demultiplexer • Study and implementation of Binary to Gray & Gray to Binary Converters • Construction and verification of various types of Up / Down, Synchronous / Asynchronous, Ripple / Reverse, Ring, Binary, BCD & Decade Counters • Construction and verification of 4 Bit Universal Shift Register (SR / SL operation). • Study of 7 - segment display and decoder / driver. • Design of BCD to Excess-3 code converter • Design various A-D & D-A convertors. 	
5.	<p>Op-Amp Trainer Specification:-</p> <ul style="list-style-type: none"> • In-built Fixed DC Power Supply: $\mu 5$ V / 500 mA, $\mu 9$V/500mA and $\mu 12$V/500mA • Inbuilt Variable DC Power Supply: +15V/500mA. • Inbuilt Fixed AC Power Supply: 9V/500mA. • Onboard Ammeter(0-3A) Onboard Voltmeter(0-200V) • In-built Function Generators: Wave forms: i) Square Wave ii) Sine wave . frequency ranges: (1) 1Hz-100Hz, (2) 100Hz-20KHz, (3) 20KHz-1MHz, (4) 150KHz-2MHz.. • Onboard Bread board. Onboard Diode Bank. • Onboard Resistor Bank: (100 , 1K, 2K, 5K, 10K, 47K, 100K, 1M, 10M). • Onboard Electrostatic Capacitor Bank (22pf, 33pf, 0.001uf, 0.01uf, 0.1uf). • Onboard electrolytic Capacitor Bank: (1uF, 10uF, 47uF, 100uF, 470uF). • Onboard Variable Resistor Bank: (0-100 , 0-1K, 0-5K, 0-10K, 0 -100K). • Onboard Op-amp ICs: IC740, IC741, IC555Timer. • Onboard NPN Transistor:- BC547. Onboard PNP Transistor · BC557. • Logic Level Indicators: 4 independent buffered logic level indicators for High / Low status. • Power ON switch with indicator and fuse for protection. • Power Requirement: 230V AC, 50Hz + 10%. <p>Experiments: can be performed:- BASIC OPERATIONAL AMPLIFIER CIRCUIT</p> <ul style="list-style-type: none"> • Study of Inverting Amplifier • Study of Non-inverting Amplifier • Study of inverting A.C. Amplifier • Study of Non-inverting A.C. Amplifier <p>SOURCE FOLLOWER</p> <ul style="list-style-type: none"> • Study of Voltage Follower (Unit gain buffer amplifier) • Study of A.C. Voltage follower <p>OP- AMPS AS ANALOGUE COMPUTER ELEMENTS</p> <ul style="list-style-type: none"> • Study of Inverting summing amplifier 	10

	<ul style="list-style-type: none"> • Study of Non-inverting summing amplifier • Study of Subtractor • Study of Differential amplifier • Study of A.C. differential amplifier • Study of Adder Subtractor • Study of Multiplication by a constant • Study of Division by a constant • Study of Integrating amplifier for DC input signals • Study of Integrating amplifier for AC input signals • Study of Differentiator amplifier • Study of Non-inverting differentiator • FUNCTION GENERATOR • Design of Square Wave generator using Op-amp. • Design of Pulse generator using Op-amp. • Design of Triangular wave generator using Op-amp. • MULTIVIBRATORS • Implementation of Astable Multivibrator. • Implementation of Monostable Multivibrator. • Implementation of Bistable Multivibrator. <p>Many other experiments are possible using the onboard components and Breadboard provided. (for use of external components)</p> <p>Accessories:- Power Cable · 1, Patch Cords · 8, User Manual · 1., e-manual-1 CD.</p>	
6.	<p>ANTENNA TRAINING SYSTEM</p> <p>Technical Specifications</p> <p>RF Signal Generator</p> <ul style="list-style-type: none"> • RF Frequency ranging from 10MHz to 600MHz. • +3dBm to · 27dBm amplitude @ 50 impedance. • Display: 4 ^{1/2} digit Red 7-segment display. <p>RF Power Meter</p> <ul style="list-style-type: none"> • RF power i/p = 15dBm to · 60dBm & max= 20dBm. • RF input Freq. ranging from 10MHz to 500MHz. • Display: 4 ^{1/2} digit Red 7-segment display. • USB interface with PC using USB IO for plotting. • Online/Offline mode selection using DPDT switch. • Meter input is 50 impedance. <p>Transmitting & Receiving Masts</p> <ul style="list-style-type: none"> • Has Aluminium rotating table base of size 180x180mm, optionally contains 2kg-cm stepper, mounted in transmitting mast only. • Stainless-steel pipe (Height: 600mm & Dia: 19mm) connected with rotating base table with a flexibility to mount diff. antennas as per expt using M8 screw/nut. • Scale with pointer to measure angle of rotation <p>Stepper Driver Panel</p> <ul style="list-style-type: none"> • Programmable stepper control with built-in power. • Stepper CW & CCW rotation control. • Provision of different stepping modes of operation of Stepper with the step resolution of 0.9° (in Half-step mode) & 1.8° (in Full & Wave-drive modes). 	02

- Drives 2kg-cm stepper motor mounted on transmitter mast using 15-pin D (M).

Directional Coupler

- Range: 50-2000MHz, Bi-direction directional coupler.
- Meant for Return Loss & VSWR measurements.
- Coupling factor = 10dB.
- All ports are provided with BNC Female sockets.
- Provided with two nos. of 50 ohm BNC termination.
- All ports are provided with BNC Female sockets.

PC based Graph Utility Software :

- ONLINE or OFFLINE modes: Either fully automatic/Semi-automatic or Manual modes.

Edit Buttons For:

- Rotation angle per step : 0.0° to 99.9° .
- Clock pulses per step : 1 to 99 clock steps.
- Time-gap between two clock pulses: 0.1 to 9.9 sec.
- Calibrating scale of polar plot by setting min & max strengths to match with power meter readings.
- Print & Save data to store & offline plotting.

List of Experiments to be performed :

- Antenna Radiation pattern observation either Manual or PC based.
 - Antenna Absolute & Relative gain measurements.
 - Antenna Beam-width measurement.
 - Antenna Front-to-Back ratio measurement.
- Antenna Return Loss & VSWR measurements using Directional Coupler.
- Polarization principle study.
- Impedance matching using Smith Chart.
- Antenna Resonance study.
- Measurement of Scattering Parameters

Antenna at 500MHz

Specifications:	Total nos. of Antenna Elements / Shape	Lengths of Antenna Elements (in mm)	Material used for Antenna Elements	Overall Dimension of Antenna (L x W) mm (Approx.)
Name of Antennas: (At 500 MHz)				
Half-wave Folded-dipole (2 Nos.)	01 / Folded	Folded: 300	Aluminium pipe	115 x 330
Yagi-Uda 3-element	03 / Straight (2) & Folded (1)	Straight: 300, 275 & Folded: 300	Aluminium pipe	250 x 330
Yagi-Uda 5-element	05 / Straight (4) & Folded (1)	Straight: 300, 275, 260, 245 & Folded: 300	Aluminium pipe	500 x 330
Yagi-Uda 7-element	07 / Straight (6) & Folded (1)	Straight: 300, 275, 260, 245, 230, 215 & Folded: 300	Aluminium pipe	500 x 330
Half-wave simple-dipole	02 / Straight	Straight: 300, 300	Aluminium pipe	120 x 330

3λ/2 simple-dipole	02 / Straight	Straight: 450,450	Aluminium pipe	115 x 920
Quarter-wave Simple dipole	02 / Straight	Straight: 75,75	Aluminium pipe	115 x 180
Half-wave folded-dipole with Reflector	02 / Straight (1) & Folded (1)	Straight: 300 & Folded: 300	Aluminium pipe	250 x 330
Circular Loop	01 / Circular (1T)	Circular: 600	Aluminium pipe	Length: 115 Height: 230
Log Periodic	14 / Straight	Straight: 98,122, 153,192,240,300, 375 (2 nos. Each)	Aluminium pipe	740 x 760
Helical	01 / Helical (3T)	Circular 3-turns to make helical (each of Dia. 600)	Aluminium pipe	Length: 250 Height: 520
Half-wave End-Fire	04 / Straight	Straight: 150,150, 150,150	Aluminium pipe	360 x 330
Quarter-wave End-Fire	04 / Straight	Straight: 150,150, 150,150	Aluminium pipe	250 x 330
Broad-side array	12 / Straight	Straight: 150 (12 nos.)	Aluminium pipe	500 x 330
Co-linear	04 / Straight	Straight: 150,150, 150,150	Aluminium pipe	360 x 330
Slot	Copper clad PCB with center slot	Slot size: 60 x 300mm	Copper PCB	300 x 450
Discone	One Disc & one Cone	Disc dia: 132 Cone: Slant ht:170 & Dia: 190	Galvanized Iron sheet (white coated)	Length: 250 Height: 220 Width: 190
Parabolic Reflector	Parabolic Dish reflector & simple dipole as feed	Parabolic reflector spec: Dia: 300mm, Depth: 25mm, Thick: 0.7mm. Feed:150mm straight pipe.	Galvanized Iron / MS sheet reflector & Aluminium pipe feed antenna.	Dia: 300 Height: 260 Width: 300
Microstrip Patch	Copper clad PCB with Rectangular Patch	Patch size: 176 x 137mm	Copper patch PCB with ground surface	193 x 260
Variable Length (λ/2 Simple Dipole)	02 / Straight	Straight: 400 to 1200 (Adjustable Length)	Steel adjustable Rod	120 x 1300

7.	<p>Communication System Trainer</p> <p>TECHNICAL SPECIFICATIONS :-</p> <ul style="list-style-type: none"> •Should have Master unit carrying useful experiment resources like AM / FM / ASK / FSK Modulation · Demodulation, Voice communication through Mic & L/S Amplifier, Voice communication through Mic Amplifier , Fiber Optics & L/S Amplifier, Fiber Optics Transmitter /Receiver etc. while the central slot will hold replaceable experiment panels. • Should have Covers Analog communication, Digital communication , Fiber optics characteristics as well as communication , Wired communication through various modular experiment panels implemented using latest state of arts VLSI/CPLDs. •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. <p>Master Unit:----- Should have built in following resources distributed on various convenient sections.</p> <p>* Power supplies DC supply: +/- 12V / 500mA, + 5V / 1A. Isolated Variable DC supply 0 - 15V / 100mA with isolated common.</p> <p>* Panel consisting of Carrier FG consist of Sine, Triangle & TTL / Square Selectable frequency from 1Hz to 1MHz in 6 ranges & Amplitude from 0 to 20 Vpp, AM [Std] with i/p + 5V, DSBSC with i/p 0 to 9.8 Vpp, FM with i/p 400mV, ASK with i/p Upto 500Hz, +5V Square Wave, FSK with i/p Upto 500Hz, +4.5V Square Wave. Audio FG consist of Sine, Triangle & Square Selectable frequency from 50Hz to 5KHz & Amplitude from 0 to 2 Vpp for Sine, from 0 to 3 Vpp for triangle & from 0 to 9 Vpp for Square. Four Sync Sine Wave of frequencies 250 Hz, 500Hz, 1KHz & 2KHz with selectable amplitude from 0 to 10 Vpp. Audio amplifier with gain upto 20 for audio rang, built in loudspeaker-8ohm/500mW/earphone. Buffer/AC amplifier with NIV gain amplifier 2 Nos, gain 0-20, for Non sinusoidal signal generator cum INV buffer. Butter Worth Filter [LPF]: 4 Nos-2 pole/4 pole butter worth filter cutoff fre 3.4 KHz audio range.</p> <p>* Panel consisting of Electret microphone with preamplifier for Voice Communication, AM /FM Transmitter with tunable carrier frequency 88 to 108 MHz for FM & adjustable gain control for AM, AM /FM Detector to detect original audio signal from AM / FM Modulation, AM / FM Receiver has 5 Separate external Socket to connect to Antenna, 2nd IF i/p, 2nd IF o/p, Speaker & Detector o/p, Fiber optics Transmitter / Receiver uses RED LED as Emitter & TIL 81 as Detector [tr = 8ms] & 1m plastic fiber cable for transmission. Its Analog Band width is in Audio range & Digital Band width is 64 KHz with CRT-1.492, NA-0.5, 660nm, step index, terminated with SMA connector. One BNC Socket to 2 Banana Sockets (4mm) Converter. ----1no.</p> <p>* Panel Consisting of</p>	10
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	<p>15-bit Pseudo Random Binary Sequence [PRBS] Generator, Pink Noise Generator up to 0.4 Vpp, 2 Pole / 4 Pole low Pass Filter with cut off frequency 3.4KHz --- 4nos. HPF / AC Amplifier with cut off frequency 3Hz & Selectable gain from 0 to 20 ----1no. HPF / AC Amplifier with cut off frequency 1.6KHz & Selectable gain from 0 to 20 ----1no. Inverting Amplifier with Selectable gain from 0 to 20 ----1no. 4 i/p or 5 i/p Summer cum Amplifier ----1no. Experiment can ve performed on Mater Unit i)Voice link using mic & LS amplifier, ii) Study of AM Xmitter / Receiver, iii) Study of FM Xmitter / Receiver, iv) Band determination of PLL as FM Detector v) PLL as FM Detector , FSK (Frequency Shift Keying) Mod / Demod [Wired] C) FSK (Frequency Shift Keying) Mod / Demod [Through FO] vi) a) Diode as AM Detector b) ASK (Amplitude Shift Keying) Mod / Demod [Wired] C) ASK (Amplitude Shift Keying) Mod / Demod [Through FO] vii) Fiber Optics Transmitter / Receiver a) Analog Bandwidth. b) Digital Bandwidth. 7.3) Voice Communication using mic, speaker & Fiber optics c) Listening to AM/FM Radio through Fiber Optics link viii) Pseudo Random Binary Sequence Generator [PRBS] ix) Study of active filters, Noise generation & elimination. a) Study of Pink Noise Generator ,b) Study of Signal To Noise Ratio of an Amplifier , c) Study of active 2nd & 4th order Low Pass Filter , d) Study of Frequency response of HPF / AC Amplifier [3H] , e) Study of Frequency response of HPF / AC Amplifier [1.6K].</p>	
7(a)	<p>1) FIBER OPTIC/LED LASER EXPERIMENT PANEL</p> <p>Fiber optic cable (plastic):Core material : PMMA (polymethyl methacrylate), Cladding material: fluorinated polymer, Fiber structure: step index type, Core cladding diameter: 90 /1000 microns, Core refractive index : 1.492, Cladding refractive index: 1.405 to 1.417, Numerical aperture : 0.5(typically), Acceptance angle: 55 to 60 degrees, Attenuation (60nm):0.3 dB/meter, Jacket material: polythene (black): 2.2 mm OD, LENGTH=1m, 5m</p> <p>Transmitter: 4 nos. LASER (780nm), RED (660nm), BLUE (470nm), IR SFH 485 (850nm), Reverse voltage: VR =5V, Forward Current: IF=100mA, Power dissipation: Ptot =200mW, Wave length at peak emission: peak = 880nm.</p> <p>Receiver 1 No. PIN photo diode: Max wave length =850 nm, Rise time and Fall Time tr & tf=5ns, Reverse voltage: 50V, Total Power Dissipation: 100mW, Photo Current: 135(>= 100 A). Function Block: AC Amplifiers: 1 nos,b]Comparator : 1 nos c] Fibre Optic Driver with : Analog Bandwidth: 500KHz(except LASER) &1MHz for LASER, Digital Bandwidth: 1 MHz (except LASER) &2MHz for LASER d] Voice link: established using microphone & speaker (Master unit [MU]) e] PC · PC Communication: Using RS · 232 interface 9 pin D · connector, Baud Rate: 2400, f] Switched faults: 4 in transmitter 4 in receiver. Accessories: N.A. APPARATUS, Bending radii stack (BR), fiber optic cable: 1m, 5m with SMA CONNECTOR, Electrical Interference Experiment Apparatus, Coupling loss apparatus, Speaker and MIC (from MU). Experiments can be performed: DC Characteristics of transmitter diodes,</p>	05

	<p>SENSITIVITY of Optical Fiber, AC Frequency Response - Analog Link & BW, Digital Frequency Response - Digital Link & B.W, Numerical Aperture, Losses in cable- i) Bending loss ii) Transmission loss iii) Coupling loss. Immunity to Electrical Noise interference of optical fiber PC interface : Using RS 232, Signal transmission using Pulse Width Modulation & Demodulation, VOICE COMMUNICATION using direct transmission as well as modulated using PWM, Voice transmission using Amplitude Modulation & Demodulation, Signal transmission using Frequency Modulation & Demodulation, SWITCHED FAULTS. Should be compatible with Master unit</p>	
	<p>Optional expansion modules (FIBER OPTIC/LED LASER EXPERIMENT PANEL</p> <ol style="list-style-type: none"> 1) High speed digital link (B.W.=2MHz) with 1m FO cable. -1 No. 2) Fiber optic tool kit - 1No. 3) Glass FO emitter detector module- 1 No. <p>Should be compatible with Master unit</p>	01 each
7(b)	<p>2) 1 channel Sampling & Reconstruction , 4 Channel TDM/PAM & PPM, PWM, PFM Mod · Demod Experiment Panel Crystal Freq.-10 MHz, Switched faults : - 4 Nos •1 channel Sampling / Reconstruction & 4 Channel TDM / PAM & Demodulation a) Modulator: Analog i/p channel: - 4 Nos, 10 Vpp, Bipolar. Settable Sampling Freq. (1of 7): 64 / 32 / 16 / 8 / 4 / 2 / 1 KHz With Settable Duty Cycle 10-90 % in decade steps. b) De-Modulator : Clock Regeneration using PLL, LPF, 1/2/3 Wire Communications. •Pulse Width Modulation [PWM] / Pulse Position Modulation [PPM] Mod - Demod a) Modulator: I/P freq: Audio range (Sine) @ 0-8 Vpp, Carrier Freq - 64KHz(TRG) @ 8 Vpp O/P · TTL. b) De-Modulator: LPF (MU), PPM is converter into PWM then Demodulated. •Pulse Frequency Modulation [PFM] Mod - Demod a) Modulator: Center Freq (64KHz / TTL) from Function Generator (MU) is FM modulated by audio signal generating PFM pulse b) De-Modulator: PLL Detector followed by LPF from MU. List of Experiment: Single channel PAM Sampling [1CH Signal Sampling & Reconstruction (1 CH SSR)] i) Natural Sampling, ii) Flat Top Sampling (Sample Hold), Multichannel [4CH / 2CH for SA] PAM Sampling, multiplexing of data over single wire & demultiplexing of data at receiver to reconstruct 4 channels by various method 3 \ 2 \ 1 wires [mode 1, 2, 3 respectively., PWM \ PFM \ PPM Pulse modulation & demodulation as a methods of digital communication Should be compatible with Master unit</p>	05
7(c)	<p>Carrier modulation/ Demodulation Experiment Panel</p> <ul style="list-style-type: none"> ➤ Carrier Sine wave-500KHz, 250KHz(0¼ phase) & 250KHz(90¼ phase) with settable amplitude 0 to 2Vpp. ➤ On board Unipolar to Bi polar Converter, Data Squaring. ➤ Carrier Modulation Techniques · ASK, FSK, PSK & QPSK. ➤ Carrier De-Modulation Techniques · ASK (Rectifier Detector), FSK (Phase Lock Loop Detector), PSK (Squaring loop Detector) and QPSK (Fourth power loop detector). ➤ Low Pass Filter · 2 Nos with Cut off Frequency 340KHz. <p>Experiment can be performed: Amplitude Shift Keying [ASK] Modulation / Demodulation, Frequency Shift Keying [FSK] Modulation / Demodulation, Phase Shift Keying [PSK] Modulation / Demodulation, Quadrature Phase Shift Keying [QPSK] Modulation / Demodulation. Should be compatible with Master unit</p>	05
7(d)	<p>2Channel Pulse Code Modulation [PCM] / Demodulation with Error Detection &</p>	05

	<p>Correction Experiment Panel</p> <p>•1 channel & 2 Channel TDM / PCM Mod - Demod: -</p> <p>a) Modulator: Analog i/p channel: - 2 Nos, 10 Vpp, Two adjustable variable DC source, Sampling Freq.16KHz per Channel for Fast mode & 0.106 Hz per Channel for Slow Mode</p> <p>b) De-Modulator: Synchronization is established by using Pseudo Random Binary Sequence Generator, Clock Regeneration using PLL, 1/2/3 Wire Communications.</p> <p>c) Error Detection: Selectable for OFF, Even Parity, Odd parity & Hamming check code.</p> <p>d) Error Correction: - Hamming code (Single or Double Data bit error.)</p> <p>•Voice communication through PCM. •Voice communication through PCM & Fiber optics using above. Switched faults: - 4 Nos. + 2 No Switches for bit error simulation</p> <p>Experiment can be performed: Single channel Pulse Code Modulation & Demodulation by various method 3/2/1 wires [mode 1, 2, 3 respectively], Two channel TDM, PCM Modulation & Demodulation by various method 3/2/1 wires [mode 1, 2, 3 respectively], Use of PRBS for frame synchronization by adding a Bit (Marker) in 2 / 1 Wire (Mode 2, 3 respectively), Study of Error Code Check such as Even Parity, Odd Parity and 1 bit / 2 bit error simulation & correction by Hamming Code, Voice and Radio communication using PCM, Study of ADC / DAC [CODEC] by observing on Leds & by applying DC Levels at single or both i/ps, Switched Faults, Study of eye diagram, PC Communication using PCM.</p> <p>Should be compatible with Master unit</p>	
7(e)	<p>Delta, adaptive Delta(CVSD), sigma delta modulation & demodulation Experiment Panel</p> <p>Consists of Voltage comparator, differential amplifier, TTL TO Bipolar, Bipolar to TTL, Bistable.</p> <p>- Switched faults (4nos.)</p> <p>-Delta, CVSD (adaptive delta), sigma modulation & demodulation, Adaptive control circuits 2nos. each provides 2 bit binary code, used to control gain of an integrator for adaptive delta modulation.</p> <p>Companding : Using compressor and expander function blocks, Study of Mu Law & A Law.</p> <p>Experiments can be performed: Delta mod-demod, Adaptive (CVSD) delta mod -demod, Sigma delta mod demod, Voice communication, Effect of companding on delta mod-demod, Switched faults.</p> <p>Should be compatible with Master unit</p>	05
7(f)	<p>AM modulation demodulation Expt. Panel</p> <p>Consisting of 2No modulators, Ceramic BPF, envelope detector, product detector.</p> <ul style="list-style-type: none"> ➤ Switched faults 4 nos ➤ Modulator - Balanced modulator (DSB · SC) · 2Nos., & DSB-TC-1No. SSB · SC- 1No. ➤ Demodulator : Envelope detect 1Nos., product detector 1No ➤ Frequency division multiplexing with 2Nos. of DSB-SC channels <p>Experiment scan be performed: DSB modulation with transmitted carrier (TC), DSB modulation with suppressed carrier (SC), Ceramic filter (BPF), SSB SC modulation (for upper/lower side band), DSB TC demodulation, DSB SC demodulation, SSB SC demodulation, ASK Demodulation using synchronous detector, QAM mod demod,FDM-AM</p>	05

	using P19(AM/FM receiver kit), Voice communication, Switched faults. (Should be compatible with Master unit)	
7(g)	<p>FM Modulation & Demodulation Expt. Panel Shares common resources like Audio FG microphone / L/S & Amp., pink noise Generator, LPF (2P / 4P) etc. from MU</p> <ul style="list-style-type: none"> ➤ Switched faults: - 8 Nos. <p>FM Mod - Demod:</p> <p>a) FM Modulator: (With center frequency 455 KHz). 1) Reactance Modulator using Arm strong oscillator. 2)Varactor Modulator with center frequency adjustment</p> <p>b) FM Demodulator: 1) Detuned resonant circuit detector 2) Quadrature detector. 3) Foster-Seeley discriminators 4) Ratio detector. 5) Phase-locked loop detector.</p> <p>Phase demodulator using quadrature detector</p> <p>Experiment can be performed: Frequency modulation using : R e a c t a n c e modulator, Varactor modulator, Phase modulator using varactor, Frequency demodulation using : Detuned resonant detector, Foster Seeley/ratio detector, Study of PLL capture & lock range & its use as FM detector, Use of PLL as Armstrong Modulator, Quadrature detector, Phase demodulation using quadrature detector, Introduction of noise & its effects on frequency modulation, Voice communication, pre-emphasis & deemphasis for flat frequency response, Switched faults.</p> <p>Should be compatible with Master unit</p>	05
7(h)	<p>AM demodulator cum AM-FM Receiver Expt. Panel Consists of antenna, IF amplifier, Local oscillator (455KHz), mixer, audio amplifier with L/S.</p> <ul style="list-style-type: none"> ➤ AM demodulator - Diode Detector for DSB. ➤ Switched faults 15 Nos. <p>Super heterodyne Receiver - AM receiver cum tunner (450 to 1450KHz), FM receiver cum tunner (88 to 108MHz)</p> <p>Experiments can be performed: AM receiver (5) : DSB TC demodulation using tuning of AM receiver, Sensitivity of radio receiver, Signal to noise ratio, Effect of AGC, Fidelity of Radio Receiver. FM receiver (3): FM demod using tuning of FM receiver, Sensitivity of radio receiver, Selectivity of radio receiver. FDM AM : Using , Frequency Division Multiplexed channel recovery.</p> <p>Should be compatible with Master unit</p>	05
7(i)	<p>Fourier analysis cum synthesis Expt. Panel</p> <ul style="list-style-type: none"> ➤ Fundamental frequency · 1KHz ➤ Split into 10 freq. Components ➤ Synthesized 10 components to generate original signal. ➤ Display frequency components on CRO using spectrum display controller in external trigger mode. ➤ Study of filters (LPF, HPF, BPF) and display characteristics curve on CRO <p>Experiments can be performed : Fourier analysis, Fourier synthesis, Spectrum Analyzer cum Fourier component display on CRO, Study of filter, Switched faults. (XY Mode) using FM sweep display.Should be compatible with Master unit</p>	05
7(j)	Transmission Line Expt. Panel	05

	<ul style="list-style-type: none"> • Consisting of 50 ohm, 70 ohm simulated line, pulse generator, 50 ohm line driver, BNC to banana adaptor- 2nos, Impedance matching variable resistors-2 nos. • Effect of pulse input, reactive termination, match termination, noise. • Standing wave display on CRO in external trigger mode & VSWR determination. • Coaxial cable (RG58) x 50m(25m x 2 nos.) & terminating BNC, • Calculation of delay, impedance, speed of light, standing wave ratio (VSWR). <p>Experiments can be performed: Delay using a pulse input, Matching using pulse input, Reactive termination, Noise in communication, Matching and frequency response, Phase relationship, Standing wave ratio and Transformer matching, Standing waves, Low pass filter effect, 50 ohm line as an oscillator, Time domain reflectometry, Switched Faults, Experiments with actual RG 58 cable used in transmission line</p> <p>Time domain experiments a) Time domain measurements. b) time domain reflectometry. c) transmission delay when using pulse input d)effect of reactive termination frequency domain experiments e) sinusoidal study state in transmission.</p> <p>Should be compatible with Master unit</p>	
7(k)	<p>Integrated Digital Communication Expt. Panel : [PSK, QPSK, 16 QAM, 8 QAM, 8 PSK, MSK differential mode & non- differential mode]</p> <p>(Provided with 12 banana + 2 TPs.+ 12 LEDs + 5 switches) On-board Clock source @5MHz.</p> <p>a) Mod/Demod Function Blocks:- Onboard adjustable DC signal source (+- 5Vpp) ,7 Bit ADC with Sampling Frequency of 6.5 KHz, 4bit selectable digital i/pϕs using switches, Sine Adder, Sine Divider, Differentiator Block,</p> <p>Scheme selector block, Frequency selector block, Quadrature sine generator I, Q @208-416KHz, MUX 2:1, Latch, PISO, SIPO(1:2, 1:3, 1:4), on board 208 KHZ, TTL reference clock, Delayed clock for cycle slip error, 7 Bit DAC with single Analog Output- 10Vpp & Audio upto1.3KHz [2KHz can be tolerated], 7 Bit Amplitude & Phase comparator, Socket selectable DAC O/P either one of the Modulation O/P or Demodulation O/P, with differential or non differential mode and recovered signal by passing through 4P Butterworth filter on NGLPF Panel (MU).</p> <p>List of experiments :</p> <p>Generate PSK, QPSK, 16 QAM, 8 QAM, 8 PSK, MSK modulated digital sin output in-differential & non-differential mode, Verify variations in phase angle [if any], amplitude [if any] & frequency [if any], Depending upon modulation bits, Draw constellation diagram for PSK, QPSK, 16 QAM, 8 QAM, 8 PSK, Demod. verification in-differential & non-differential mode for all schemes, Determine upper limit of data rate given a particular carrier frequency, Send and receive voice using PSK, QPSK, 16 QAM, 8 QAM, 8 PSK, MSK, Cycle slip error in 8PSK & 8QAM, Bit Error Ratio (BER).</p> <p>Should be compatible with Master unit</p>	05