



**JAI HIND COLLEGE  
BASANTSING INSTITUTE OF SCIENCE  
&  
J.T.LALVANI COLLEGE OF COMMERCE  
(AUTONOMOUS)**

"A" Road, Churchgate, Mumbai - 400 020, India.

**Affiliated to  
University of Mumbai**

Program: B.Sc.

Proposed Course: Physics (Applied Component )

Analog Circuits, Instruments and Consum Appliances

Semester - V

**Credit Based Semester and Grading System (CBCS) with effect from the  
academic year 2020-21**

<b>Semester V</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Lectures /Week</b>
<b>SPHY5AC</b>	Analog Circuits, Instruments and Consumer Appliances	2.5	4
<b>SPHY5ACPR</b>	Electronic instrumentation practical I	2.5	4



## Semester V Course I

<b>Course Code</b> SPHY5AC	<b>Analog Circuits, Instruments and Consumer Appliances (Credits :2.5, Lectures/ week : 4)</b>	
<b>Course description:</b> To introduce students to electronic instrumentation principles and its applications		
<b>Objectives</b>		
<ol style="list-style-type: none"> <li>1. Understand the working of transducers, signal generation and conditioning, data acquisition systems and measuring instruments.</li> <li>2. Understand the modern techniques in the field of medical science.</li> <li>3. Understand PCB designing and working of consumer electronic devices.</li> </ol>		
<b>THEORY</b>		<b>60 lectures</b>
<b>Sub Unit</b>	<b>Unit – I: Transducers and Optoelectronics Devices</b>	<b>15 L</b>
<b>1</b>	<b>Transducers:</b> Definition, Classification, Selection of transducer	
<b>2</b>	<b>Electrical transducers:</b> Thermistor, Thermocouple, Resistance thermometer, Capacitive transducer, Pressure Transducer: Strain gauges (wire, foil, & semiconductor), Displacement transducer: LVDT, Peizo-electric Transducer, load cell	
<b>3</b>	<b>Electronic Weighing Systems:</b> Operating principle, Block diagram, features	
<b>4</b>	<b>Optoelectronic Devices:</b> LDR, liquid crystal display (DSM in detail) comparison between LED and LCD, Photodiode (construction, Characteristics & applications), Phototransistor.	
<b>Unit – II: Signal Generation , Conditioning And Measuring Instruments</b>		<b>15 L</b>
<b>1</b>	Half wave precision rectifier, Active Peak detector, Active Positive Clamper.	
<b>2</b>	Active Positive and Negative Clippers	
<b>3</b>	<b>Wave form generation:</b> Triangular wave generator, sawtooth wave generator and square-triangular wave generator using op-amp.	
<b>4</b>	<b>Instrumentation Amplifier &amp; its applications:</b> Basic instrumentation amplifier, applications of instrumentation amplifier: temperature indicator, light intensity meter, analog weight scale	
<b>5</b>	<b>Cathode Ray Oscilloscope:</b> Single trace CRO (Block diagram), Front Panel Controls (Intensity, Focus, Astigmatism, X & Y position, level knob, time base (Time/Division) and attenuation (Volts/Division) knobs, X-Y mode), Dual Trace CRO (Block diagram), Probes: 1:1&10:1. Digital Storage Oscilloscope	
<b>6</b>	<b>DMM:</b> 3½ Digit, resolution and sensitivity, general specification	

	<b>Unit – III: Data Acquisition and Conversion</b>	<b>15 L</b>
<b>1</b>	<b>Data acquisition system:</b> Objectives of DAS, Signal conditioning of inputs, Single channel Data Acquisition system, Multichannel Data Acquisition system. [Data Transmission systems].	
<b>2</b>	<b>D to A Converters:</b> Resistive divider network, Binary ladder network	
<b>3</b>	<b>A to D Converters:</b> Successive approximation type, Voltage to Time (Single slope, Dual slope).	
	<b>Unit IV: Modern Techniques and Consumer Appliances &amp; SMPS</b>	<b>15 L</b>
<b>1</b>	<b>Printed Circuit Board:</b> Idea of PCB, advantages, copper clad, Etching processes, Principle of Photolithography (For PCB).	
<b>2</b>	<b>Microwave Oven:</b> Operating principle, block diagram, features.	
<b>3</b>	<b>Medical instruments:</b> Bio-Potential, Types of electrodes, ECG, EEG, EMG, CT Scan and MRI (principle, block diagram and features), Ultrasonography: working principle	
<b>4</b>	<b>Switching Regulators:</b> Basic and Monolithic Switching regulators (buck, boost and buck – boost) (Only basic Configurations)	
<b>ICA (Internal Continuous Assessment)</b>		
Class test, Seminars, Assignments and Class performance.		
<b>References:</b>	<ol style="list-style-type: none"> <li>1. R S Sedha, <i>A Textbook of Applied Electronics</i>: S Chand &amp; Company, New Delhi.</li> <li>2. B. L. Thereja, (5<sup>th</sup> edition), <i>Basic Electronics Solid state</i>., S Chand &amp; Company, New Delhi.</li> <li>3. H S Kalsi, (4<sup>th</sup> edition) ,<i>Electronic Instrumentation</i>: Tata McGraw-Hill Publishing Company Limited, New Delhi.</li> <li>4. Alan S. Morris., Butterworth-Heinemann, <i>Measurement and Instrumentation Principles</i>:</li> <li>5. B. S. Sonde, (1<sup>st</sup> edition ),<i>Transducers and display systems</i>: Tata McGraw-Hill Publishing Company Limited, New Delhi.</li> <li>6. A.P. Malvino and D. P. Leach,( 7<sup>th</sup> edition) ,<i>Digital principles and applications</i>., Tata McGraw-Hill.</li> <li>7. A. K. Sawhney, <i>A course in electrical and electronic Measurements and Instrumentation</i>: Dhanpat Rai and Sons. <a href="https://www.scribd.com/document/258017718/A-K-sawhney-A-Course-in-Electrical-and-Electronic-Measurements-and-Instrumentation">https://www.scribd.com/document/258017718/A-K-sawhney-A-Course-in-Electrical-and-Electronic-Measurements-and-Instrumentation</a></li> <li>8. S. M. Dhir, <i>Electronic components and materials: Principles, Manufacture and Maintenance</i>: Tata McGraw-Hill Publishing Company Limited, New Delhi.</li> <li>9. B. S. Sonde, <i>Data Converters</i>: Tata McGraw-Hill Publishing Company Limited, New Delhi.</li> <li>10. Albert D. Helfrick, Willam D. Cooper, <i>Modern Electronic Instruments and Measurement techniques</i>: Prentice Hall India Pvt. Ltd, New Delhi.</li> <li>11. C.S.Rangan, G.R. Sarma, V.S. Mani, (2nd Edition) , <i>Instrumentation Devices &amp; Systems</i>: Tata McGrawHill</li> </ol>	

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|  | <p>12. R. P. Bali, (2008) , <i>Consumer Electronics</i> : Pearson Education .</p> <p>13 S.P Bali, ,( 2008 Edition )<i>Consumer Electronic</i>: Pearson Education Asia Pvt., Ltd.</p> <p>14. Clyde F. Coombs. Jr. , (6<sup>th</sup> edition)<i>Printed Circuits Handbook pdf</i>: McGraw HillHandbooks,</p> <p>15. Mahmoud Wahby, (Nov 2013)<i>EDN Networks, PCB design basics</i>:</p> <p>16. Joseph-Du-bary, <i>Introduction to Bio-medical Electronics</i>: McGraw Hill Co. Ltd.</p> <p>17.- J. C. Wobster, <i>Medical instrumentation Application and design</i>:</p> <p>18. L. Cromwell, F. J. Weibell, <i>Biomedical instruments and measurements</i>:Prentice hall of India of India Pvt. Ltd, New Delhi.</p> |
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<b>Course Code</b> SPHY5ACPR	<b>Electronic Instrumentation Practical-I</b>	<b>2.5 Credits, Lectures/week 04</b>
<b>Learning Objectives:</b>	<ol style="list-style-type: none"> <li>1. To correlate theory concepts.</li> <li>2. Develop basic experimental skills through conduct of experiments.</li> </ol>	
<b>SEMESTER-V PRACTICALS</b>		
<ol style="list-style-type: none"> <li>1. Thermistor Characteristics –Thermal and electrical.</li> <li>2. Thermistor as sensor in temperature to voltage converter using OPAMP.</li> <li>3. OPAMP D/A Converter: Binary weighted resistors/Ladder network</li> <li>4. Square and Triangular wave generator using OPAMPs</li> <li>5. Second Order active Low Pass filter (frequency response &amp; phase relation).</li> <li>6. Second Order active High Pass filter (frequency response &amp; phase relation).</li> <li>7. Active Notch Filter (frequency response &amp; phase relation).</li> <li>8. Constant Current source using OPAMP and PNP transistor (o/p current less than 50 mA).</li> <li>9. LM 317 as constant current source.</li> <li>10. Study of variable dual power supply using LM 317 &amp; LM 337 (<math>\pm 3v</math> to <math>\pm 15v</math>).</li> <li>11. Basic Instrumentation Amplifier using 3 Op-Amps coupled to resistance bridge.</li> </ol>		
<b>ICA</b> <b>(Internal Continuous Assessment)</b>		
Continuous practical evaluation /seminar /Journal Report and Viva-voce.		
<b>References:</b>	<ol style="list-style-type: none"> <li>1. Albert D. Helfrick &amp; William D. Cooper, 1997, <i>Modern Electronic Instrumentation &amp; Measurement Techniques</i>, Prentice Hall India Publications</li> <li>2. Coughlin &amp; F. F. Driscoll, 6<sup>th</sup> ed., <i>OPAMPs and linear integrated circuits</i>, Prentice Hall of India Publications</li> <li>3. R.A. Gayakwad, 4<sup>th</sup> edition, <i>OPAMPs and linear integrated circuits</i>, Prentice Hall of India Publications</li> <li>4. A. P. Malvino, 6<sup>th</sup> edition, <i>Electronic Principles</i>, Tata McGraw Hill Publications</li> <li>5. H. S. Kalsi, 2<sup>nd</sup> Edition, <i>Electronic Instrumentation</i>, Tata McGraw Hill Publications</li> <li>6. Malvino and Leach, 5<sup>th</sup> edition, <i>Digital Principle and Applications</i>, Tata McGraw Hill Publications</li> <li>7. R .P. Jain, 3<sup>rd</sup> edition. <i>Modern Digital Electronics</i>, Tata McGraw Hill Publications</li> <li>8. R. S. Khandpur, Handbook of medical instruments, 2<sup>nd</sup> edition, Tata McGraw Hill Publications</li> </ol>	

**[A] Students will come for one turn of 3 hours per week for the laboratory sessions(performing practical).**

A minimum of 8 experiments from practical course are to be performed and reported in the journal.

The certified journal must contain a minimum of 8 experiments from the practical course.

### **Evaluation Scheme**

**[A] Evaluation scheme for Theory course SPHY5AC**

- **Continuous Assessment ( C.A.) - 40 Marks**

- i. C.A.-I : Test – 20 Marks of 40 mins. Duration
- ii. C.A. –II: Assignment of problems/seminars/class performance

- **Semester End Examination ( SEE)- 60 Marks**

**[B] Evaluation scheme for Practical course**

<b>Total marks : 100</b>				
<b>Continuous Internal Assessment (CIA)</b>		<b>Semester End Examination ( SEE)</b>		<b>Total</b>
<b>40% (40 marks )</b>		<b>60% (60 marks )</b>		
<b>Rough journal</b>	<b>Journal</b>	<b>Viva-Voce</b>	<b>Experiment</b>	<b>Total</b>
<b>20</b>	<b>10</b>	<b>10</b>	<b>60</b>	<b>100</b>

**Practical examination will be of two and half hours. Students will perform 1 experiment of two and half hours duration.**

**Note: Certified journal is a must for the student to appear for practical examination.**