



Autonomous

(Affiliated to Mumbai University)

**Syllabus for T. Y. B. Sc. Physics**

**Applied Component**

**(Choice Based Credit System**

**w. e. f. academic year 2018-19)**

**Program Code: RJSUPHY**

**Ramniranjan Jhunjhunwala College**  
**(Autonomous)**

**Affiliated to University of Mumbai**

**SYLLABUS FOR SEM – V &VI**

Program : B.Sc. Physics

Course : Applied Component

Program Code: RJSUPHY

Department of Physics

(Choice Based Credit System w. e. f.  
Academic year 2018–2019)

**Syllabus for T. Y. B. Sc.  
Applied Component- Electronic Instrumentation**

**SEMESTER V  
THEORY**

<b>RJSUPHYAC505</b>	<b>Analog Circuits, Instruments and Consumer appliances</b>	<b>No. of Credits</b>	<b>Lectures /Week</b>
Unit I	Transducers, Sensors and Optoelectronics Devices	<b>02</b>	<b>04</b>
Unit II	Signal conditioning, SMPS and Measuring Instruments		
Unit III	Data Acquisition and Conversion		
Unit IV	Consumer Appliances		

**Practicals**

<b>RJSUPHYAC50P1</b>	Analog Circuits and Instruments and Consumer Appliances	<b>02</b>	<b>04</b>
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**SEMESTER VI  
THEORY**

<b>RJSUPHYAC605</b>	<b>Digital Electronics, Scilab and OOP, Numerical Analysis using C++</b>	<b>No. of Credits</b>	<b>Lectures /Week</b>
Unit I	Digital Electronics	<b>02</b>	<b>04</b>
Unit II	Introduction to Scilab		
Unit III	Basic programming using C++.		
Unit IV	Numerical Analysis using C++		

**Practicals**

<b>RJSUPHYAC60P1</b>	Digital Electronics, Scilab, Programming of C++.	<b>02</b>	<b>04</b>
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## Semester V

### COURSE CODE: RJSUPHYAC505

## ANALOG CIRCUITS, INSTRUMENTS AND CONSUMER APPLIANCES

### Unit- I: Transducers, Sensors and Optoelectronic Devices

(15 lectures)

1. **Transducers:** Definition, Classification, Selection of transducer.
2. **Electrical transducers:** Thermistor, Thermocouple, Pressure Transducer: Strain gauges (wire, foil & semiconductor), Displacement transducer. LVDT, Piezo-Electric Transducer [Ref. 2, 3, 6 & 9]
3. **Chemical sensors:** pH sensor, Gas sensor (Fundamental aspects), Humidity sensor (Resistive). [Ref 6, 7].
4. **Optoelectronic Devices:** LDR, LED (Construction, Working & Applications), multicolor LED, Seven Segment Display, Liquid Crystal Display (LCD), Photodiode (construction, Characteristics & applications), LDR, Introduction to phototransistor. [Ref. 1, 2 & 3]

### Unit- II: Signal Conditioning, SMPS and Measuring Instruments

(15 lectures)

1. Half wave precision rectifier, Active Peak detector, Active Positive Clamper [M & B].
2. Active Positive and Negative Clippers [Ref 17]
3. **Switching Regulators:** Basic and Monolithic Switching regulators (buck, boost and buck – boost) (Only basic Configurations) [Ref 3]
4. **Cathode Ray Oscilloscope:** 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 [R 3 & 10].
5. **DMM:** 3 ½ Digit, resolution and sensitivity, general specification. [R 3]

### **Unit-III: Data Acquisition and Conversion**

**(15 lectures)**

1. **Data acquisition system:** Objectives of DAS, Signal conditioning of inputs, Single channel Data Acquisition system, Multichannel Data Acquisition system. [Data Transmission systems IEEE-488 GPIB\*] [Ref. 11]
2. **D to A Converters:** Resistive divider network, Binary ladder network[Ref 7 & 8]
3. **A to D Converters:** Successive approximation type, Voltage to Time (Single slope, Dual slope). [Ref. 7 & 8]

### **Unit-IV: Consumer Appliances**

**(15 lectures)**

1. **Printed Circuit Board:** Introduction, Advantages, classification, Principle of Photolithography (For PCB). [Ref. 4, 13 & 14].
2. **Microwave Oven:** Operating principle, block diagram (For Explanation), features.[Ref. 12 ]
3. **Medical Instruments:** Bio-Potential, Types of Electrodes, ECG, EEG, EMG, CT scan and MRI (Principle, Block Diagram(For Explanation) and features), Ultrasonography : Working principle [ Ref 15,16 ]

### **References:**

1. A Textbook of Applied Electronics – R S Sedha, S Chand & Company, New Delhi.
2. Basic Electronics Solid state - B. L. Thereja, S Chand & Company, New Delhi.
3. Electronic Instrumentation – H S Kalsi, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Electronic components and materials: Principles, Manufacture and Maintenance- S. M. Dhir, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. Measurement and Instrumentation Principles: Alan S. Morris., Butterworth-Heinemann.
6. Transducers and display systems: B. S. Sonde, Tata McGraw-Hill Publishing

Company Limited, New Delhi.

7. Digital principles and applications: A.P. Malvino and D. P. Leach. Tata McGraw-Hill.
8. Data Converters— B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
9. Modern Electronic Instruments and Measurement techniques- Albert D. Helfrick, Willam D. Cooper, Prentice Hall India Pvt. Ltd, New Delhi.
10. A course in electrical and electronic Measurements and Instrumentation: A. K. Sawhney, Dhanpat Rai and Sons.
11. Instrumentation Devices & Systems , 2nd Edition Tata McGrawHill- C.S. Rangan, G.R. Sarma, V.S. Mani
12. S.P Bali, “Consumer Electronics”, Pearson Education Asia Pvt., Ltd., 2008 Edition,
13. Printed Circuits Handbook pdf, Clyde F. Coombs. Jr., McGraw Hill Handbooks, 6<sup>th</sup> ed.
14. PCB design basics, Mahmoud Wahby, EDN Networks, Nov 2013.
15. Medical Instrumentation Application and Design- J. G. Webster
16. Biomedical instruments and Measurements-L. Crowell, F. J. Weibell, Prentice Hall of India Pvt. Ltd., New Delhi.
17. OPAMPs and linear integrated circuits by R.A. Gayakwad (4<sup>th</sup> edition, PHI)

## **PRACTICALS (Semester V)**

### **Course Code: RJSUPHYAC50P1**

1. A minimum of **02** experiments from each group are to be performed and reported in the journal.
2. The certified journal must contain a minimum of **8** regular experiments
3. Use of Bread Boards is preferred wherever necessary.
4. Enough number of practical session including repetition turns will be conducted by respective department in practical laboratory.

#### **GROUP - A**

1. Thermistor Characteristics –Thermal and electrical (H & C)
2. Thermistor as sensor in temperature to voltage converter using OPAMP (C&D Ch.8)
3. Study of LVDT characteristics (K Ch. 13)
4. Study of Load Cell / Strain Guage (K Ch. 13)
5. Study of seven segment display
6. Characteristics of Photo diode and photo transistors

#### **GROUP - B**

1. Basic Instrumentation Amplifier using 3 Op-Amps coupled to resistance bridge (C&DCh.8 )
2. Temperature to frequency Conversion using 555 timer. (C &D Ch. 13)
3. OPAMP D/A Converter: Binary weighted resistors
4. OPAMP D/A Converter: Ladder network (M & L Ch. 12)
5. Sample and hold circuit using op-amp 741. (G Ch. 8)
6. Peak detector using Op-amp 741. (G Ch. 8)

#### **GROUP – C**

1. Half wave precision rectifier using precision op-amps (OPA177). (C & D Ch. 7)
2. Positive and Negative Clippers using op-amp. (G Ch. 8)
3. Positive and Negative Clampers using single power supply op-amp (124/324). (G Ch. 8)
4. Second Order active Low Pass filter (frequency response & phase relation)
5. Second Order active High Pass filter (frequency response & phase relation)

(K.Ch15)

6. Active Notch Filter (frequency response & phase relation) (K.Ch.15)
7. Square and Triangular wave generator using OPAMPs with concept of duty cycle. (M.Ch 23).

#### **GROUP - D**

1. Study of variable dual power supply LM 317 & LM 337 ( $\pm 3\text{v}$  to  $\pm 15\text{v}$ ). (C&D Ch.13)
2. Constant Current source using OPAMP and PNP transistor (o/p current less than 50 mA) (C & D Ch 5)
3. Making PCB for simple circuits (rectifiers, regulators, oscillators, multivibrators, op-amp applications, single stage amplifier etc.), building and testing of the circuits
4. Visit to Hospital/Diagnostic Centre/Biomedical Research Laboratory and Submission of its report.
5. (i) Simple microphone amplifier using a transistor.  
(ii) Low voltage audio amplifier using IC LM386  
(iii) Audio power amplifier using IC TBA 810.

[Experiment No. 4 may be Hands-on OR Demo experiment which are equivalent to 2 regular experiments and need not to be performed during the Practical Examination Visit to Hospital/Diagnostic Centre/Biomedical Research Laboratory and Submission of its report is equivalent to 2 Regular experiments.

Learner will be examined for Expt. 3, 4 and 5 on the basis of submitted report, PPT and viva and need not perform regular experiment during the Practical Examination].

#### **References:**

1. H & C : Modern Electronic Instrumentation & Measurement Techniques By Albert D. Helfrick & William D. Cooper PHI) EE Edition
2. C & D : "OPAMPs and linear integrated circuits" by Coughlin & F. F. Driscoll (6<sup>th</sup> edition PHI)
3. G: OPAMPs and linear integrated circuits by R.A. Gayakwad (4<sup>th</sup> edition, PHI)
4. M: "Electronic Principles" by A. P. Malvino (6th edition, PHI)
5. K: Electronic Instrumentation by H. S. Kalsi (TMH) 2<sup>nd</sup> Edition
6. M & L : Digital Principle and Applications" by Malvino and Leach (5th edition, TMH)
7. RPJ : Modern Digital Electronics 3rd edition (TMH) – R .P. Jain.



## **Semester VI**

### **COURSE CODE: RJSUPHYAC605**

#### **Digital Electronics, Introduction to Scilab, C++ Programming and numerical Analysis using C++.**

##### **Unit 1: Digital Techniques**

**(15 Lectures)**

1. Combinational Logic Design: Introduction, Boolean identities, K – map (2, 3 and 4 variable), Ref: N G P 4.1 – 4.8.(additional ref. RPJ)
2. Design and implementations of : Decoders, Encoders, Multiplexers, Demultiplexers, Use of MUX and DEMUX in Combinational Logic design. Code Converters. Tri-State logic, buffer, D latch.

##### **References:**

N G P - 5.1 (only introduction), 5.3, 7.1 -7.6 (except 7.5)

RPJ - 4.20.

RG: 3.5.1, 3.5.2, 3.5.3, 3.5.4 & 3.5.5

1. NGP: Digital Electronics and Logic design by N G PALAN,  
[https://archive.org/details/hellomr82k\\_gmail\\_DE](https://archive.org/details/hellomr82k_gmail_DE)
2. RG: Microprocessor Architecture, Programming and Applications with the 8085.  
Ramesh Gaonkar, 5<sup>th</sup> Edition
3. RPJ: R. P. Jain, Modern Digital Electronics, Tata McGraw Hill, 4<sup>rd</sup> Edition

##### **Unit 2 : Introduction to Scilab**

**(15 Lecture)**

1. Introduction to open source software's, overview of Scilab, how to get and install Scilab, how to get help, the console, the editor, ducking, using exec, batch processing.
2. Basic elements of the language: variable names, complex numbers, integers, floating point integers, the ansvariables, strings.
3. Matrices : Overview, Create a matrix of real values, Accessing the elements of a matrix, low-level operations, element wise operation.
4. Looping and branching: if statement, the select statement, the for statement, the

while statement, Break and Continue statement.

5. Functions overview: defining a function, function libraries.
6. Plotting: Overview, 2D plot, contour plots, titles, axes and legends export.

## References:

1. **Scilab: I. Fundamentals** Scilab, From Theory to Practice-Perrine Mathieu, Philippe Roux 2016 ISBN:978-2-8227-0293-5
2. **Scilab (A Free Software to Matlab)** H Ramchandran, A. S. Nair 2011 ISBN 978-8121939706
3. **Programming in Scilab**: by Vinu V Das, 2008 New Age International Publishers.
4. **ScilabA Beginner's Approach** by Anil Kumar Varma. 2018 Cengage India Publishers.

{Scilab is numerical computation software that anybody can freely download. Available under Windows, Linux and Mac OS X, Scilab can be downloaded at the following address: <http://www.scilab.org/> With an Internet connection, one can visit Scilab website where you will find a section dedicated to the use of Scilab} (<http://www.scilab.org/support/documentation>), with links and relevant documents which can be freely downloaded and printed.)

## **Unit 3 : Basic programming using C++.**

**(15 lectures)**

1. What is C++?, Applications of C++, A simple C++ program, More C++ Statements, Example with Structure of C++ Program, Creating the Source File, Compiling and Linking.
2. Expressions in C++: Introduction, Tokens, Keywords, Identifiers and Constants, Basic Data Types, Declaration of Variables, Reference Variables, Operators in C++, Expressions and Their Types, Special Assignment Expressions, Implicit Conversions, Operator Precedence.
3. Control Structures and Functions: The Main Function, Function Prototyping, Call by Reference, Return by Reference, Math Library Functions.

**Reference:**

1. EB: Object Oriented Programming with C++ by E Balagurusamy, Third /Fourth Edition, Tata McGraw-Hill Publishing Company Limited.

**Unit 4 : Numerical Analysis using C++.****(15 lectures)**

1. Errors in computation : inherent errors in storing, Numbers due to finite bit representation to use in computer, truncation error, round off errors (Explain with the help of excel)
2. Ordering: bubble sort, series evolution, root finding, bisection and Newton – Raphson method.
3. Function evolution:  $\sin x$ ,  $\cos x$ ,  $e^x$ , numerical differentiation, numerical integration, trapezoidal, simpson -  $\frac{1}{3}$ .
4. Least square curve fitting, Discussion of algorithm and flowcharts, writing C program for straight line with example in physics.

**Reference:**

Starting out with C++ by Tony Gaddis, Third Edition, Addison Wesley Publishing Company.

**Additional references:**

1. Microprocessor and Applications by Vibhute and Borole, Techmax Publications,
2. Microprocessor, Principles & Applications by Gilmore (2<sup>nd</sup> Ed) TMH
3. Programming with C++ by D. Ravichandran, Tata McGraw-Hill Publishing Company Limited.
4. “Digital Electronics “by A.P Godse & D.A Godse Technical publications, Pune, Revised third edition, 2008. Pg.No:2.25-2.70 (for Kmaps)

## **PRACTICALS (Semester VI)**

**Course Code: RJSUPHYAC60P1**

1. A minimum of **02** experiments from each group are to be performed and reported in the journal.
2. The certified journal must contain a minimum of **8** regular experiments
3. Use of Bread Boards is preferred wherever necessary.
4. Enough number of practical session including repetition turns will be conducted by respective department in practical laboratory.

### **GROUP A**

1. Study of Latch (74LS373) and its applications.
2. Study of 8:1 Multiplexer (74LS151), 1: 4 De-multiplexers (74LS155) and their applications.

### **GROUP B**

1. Solving given differential equation and plot the results.
2. Finding eigenvalues and eigenvectors different matrices.

REF: **Scilab Manual for Signals and Systems by Mrs Nalini Karchi...-**

**Scilab.inhttps://scilab.in/lab\_migration/generate\_lab/31/1**

### **GROUP C**

C++Programming

1. Program using simple formula.
2. Program using if-else-if.
3. Program using loop.

### **GROUP D**

C++ Programming:

1. Program to sum a series.
2. Program to find Root.
3. Program to integrate given function.

**T Y B Sc Applied Component (Credit based Semester and Grading System) PHYSICS**  
**Course code: RJSUPHY**

**Course outcomes:**

Upon completion of this course, students will be able to

1	Understand the Instruments used in the laboratory and everyday life.
2	Understand the concepts of Electronics instrumentation and their working.
3	Understand the basic concepts of Data Acquisition System and Medical Instruments.
4	Understand the basic concepts of Transducers and their applications, Signal conditioning and SMPS working.
5	Learn the programming languages C++ and Learn the basic concepts of Computation software SCILAB.
6	Understand the scope of Electronics in Industry by studying optoelectronics, Microprocessor etc.

**Learning outcomes:**

Upon completion of this program, students will be able to

1	Understand the concept of Transducers, energy conversion, types of sensors, Optoelectronic devices and their working.
2	Study the internal structure of Cathode Ray Oscilloscope, Digital Multimeter, Switch mode power supply etc.
3	Understand the concepts rectifiers, clipping and clamping circuits using diodes.
4	Analyze the working and types of Data Acquisition System.
5	Understand the concept of Analog to Digital converter and Digital to Analog converter. Study their types and working of each.
6	Understand the working of microwave oven and its advantages.
7	Understand the concept of printed circuit board and its classification based on materials used for construction and photolithography process.
8	Analyze the Electrocardiogram (ECG) and Electroencephalogram (EEG) waveforms and study the working of the instruments.
9	Understand the concept of Electromyogram (EMG) and study its block diagram.
10	Study the effect of electric and magnetic field in magnetic resonance phenomenon. Understand the working of Magnetic Resonance Imaging (MRI)
11	Understand the concepts of Multiplexers, Demultiplexer and their types and applications.
12	Explain the concept of combinational Logic Designs and use of MUX and DEMUX in it.

13	Learn the object oriented programming OOP C++ and use it to write programs for mathematical operations.
14	Study Computational software Scilab and its programming and use it to write simple programs.
15	Learn various plotting options of Scilab.