Placed at the meeting of
Academic Council
held on 26.03.2018

APPENDIX - AK

MADURAI KAMARAJ UNIVERSITY

(University with Potential for Excellence)

ANCILLARY – APPLIED ELECTRONICS AND INSTRUMENTATION for B.Sc., (PHYSICS)

REVISED SYLLABUS

(Revised Syllabus with effect from the academic year 2018-2019)

1. Introduction of the Programme

Applied electronics and Instrumentation is ancillary paper for B.Sc., (PHYSICS) students, It spread over 4 semesters.. The programme of study shall consist of 4 Theory papers and 2 practicals. Each of these carries 100 marks. It has been developed to provide students the opportunity to be trained in recent development in Electronics and Instrumentation. The course is designed to impart the students a vigorous training in Electronics and Instrumentationboth in theory and experiments. Our approach is a comprehensive one. It is believed that teachingstudents both how to ask and address questions. Thisprogramme has been designed to expose students' knowledge in Electronics and Instrumentation to contemporary national and international problems. At the end of the course, students are expected to have state-of-the-art quantitative skills valued both in academia and in the corporate world. During the course time, one gets an in-depth knowledge in electronics and Instrumentation

2. Eligibility for Admission

It is ancillary papers for B.Sc., (PHYSICS) students.

3. Objectives of the Programme

- To offer knowledge, understanding and skills.
- To offer the knowledge towards the Electronics equipment's.
- To improve the employability of the studentsfocusing the needs of worlds various MNC's

4. Outcome of the Programme

- It serves as a basis to build a strong academic profile for further studies.
- On successful completion of this course, one can apply for the PG courses related to Electronics, Instrumentation and Computer Science.
- The degree holders can opt employment in various MNC's and industries.

5. Theory Papers

Subject papers shall consist of 4 papers as listed below.

Paper- I : Physics of Electronic Devices

Paper – II: Applications of Electronic Devices and Instrumentation
Paper – III: Linear Integrated Circuits
Paper – IV: Electronic Communication

6. Practical Papers

Practical Lab-I: Electronics Devices and Circuit Lab
Practical Lab-II: Linear and Digital ICs lab

7. Unitization

Each subject Paper shall consist of five units. One unit (preferably the 5th Unit) will be handled by the students as a part of peer team teaching / learning process.

8. Pattern of Semester Examination

Odd semester examinations shall be conducted in the month of November. The even semester examinations shall be held in the month of April. Each paper shall carry 100 marks of which 25 marks for internal assessment and 75 marks for external examinations for all the theory papers. For practical's, 40 marks for internal, 60 marks for external. Practical examination will be conducted at the end of each year.

9. Scheme of Internal Assessment

The components of Internal Assessment marks shall be as follows, for theory.

Test	:	10 Marks (Average of the best two tests)
Assignment	:	5 Marks
Seminar/ Group Discussion	:	5 Marks
Peer- team teaching	:	5 Marks
Total	**:**	**25 Marks**

For Practical, 40 marks for internal.

10. External Examinations

External examination for each Theory paper shall be conducted for 75 marks.

Section A: 10 Multiple choice questions (One question from each unit) (10 x 1 = 10 marks)
Section B: 5 Either / Or type questions (One question from Each Unit) (5 x 7 =35 marks)
Section C: 3 Out of 5 questions. (3 x 10=30 marks)
Total : 75 Marks.

For Practical's, 60 marks for external. Practical examination will be conducted at the end of year.

11. Question paper pattern

Internal Examination of each paper shall be for 10 marks having the following question pattern.

Section A	:	6 Objective type questions	(6 x 1=6 marks)
Section B	:	2 questions (either or type)	(2 x 7=14 marks)
Section C	:	One out of 2 questions	(1 x 10=10 marks)

Total : 30 marks which shall be converted into 10 marks.

External examination of each paper shall be for 75 marks having the following question paper pattern, for theory papers.

Section A: 10 Objective type questions (2 questions from Each unit) (10 x 1=10 marks)

Section B: 5 questions, either or type (one question from Each unit) (5 x 7=35 marks)

Section C: 3 out of 5 questions (one question from Each unit) (3 x10=30 marks)

Total: 75 marks

12. Scheme of Evaluation

Students shall be evaluated on the basis of internal tests, seminars, and assignments, peer-teaching and external examinations. Question paper setters shall be requested to prepare scheme of valuation for all the papers.

13. Passing Minimum

Total Passing Minimum	:	40 Marks out of 100 Marks
Internal Assessment	:	No minimum pass mark out of 25 Marks
External Assessment	:	27 Marks out of 75 Marks

14. Model Question Paper

Maximum Time: 3 hrs Maximum Marks: 75

Section A (10 x 1 = 10 Marks)

Answer All Questions

All Multiple Choice Questions

Two Questions from each Unit

(Questions are numbered from 1 to 10)

Section B (5 x 7 = 35 Marks)

Answer all the Questions

(Either / Ortype: Either (a) or (b))

One question from each Unit

(Questions are numbered from 11 to 15)

Section C **(3 x 10 = 30 Marks)**

Answer any three Questions

One question from each Unit

(Questions are numbered from 16 to 20)

15. Teaching Methodology

Methodology shall consist of stimulation of students' interest, presentation of teaching material, team formation and activities' determination, conduction of activities and discussions and assessments. For the sake of simplicity and easy understanding, the methods like problem solving, discussion, lab demonstration and lecture shall be adopted. The use of ICT shall be co-opted for the visual presentation of the lessons. One unit (mostly 5th unit will be handled by the students).

16. Text Books

The list of text books is given at the end of syllabus of each paper.

17. Reference Books

The list of reference books is given at the end of syllabus of each paper.

18. Re-totalling and Revaluation Provision

Students shall be provided the facility of applying for re-totalling the marks within 15 days after the publication of results on payment of a minimum fee fixed by the University and they shall be allowed to apply for revaluation of their papers within 15 days after the publication of results on payment of a fee to be fixed by the University.

19. Transitory Provision (3+3)

Syllabus revision shall be done once in 3 years and afterwards 3 years shall be under transitory provision.

20. Subjects and paper related websites.

The related websites for each paper shall be provided at the end of the syllabus wherever necessary.

Paper –I
Physics of Electronic Devices

UNIT- I: **Energy Band and Charge Carrier in Semiconductors**

Energy band in solids: Energy band – Metal, Semiconductor and Insulators – Direct and Indirect Semiconductors.**Charge Carriers in Semiconductor:** Electron and Holes – Effect Mass in intrinsic semiconductors, dependence of Fermi level on temperature and doping concentration.**Carrier concentration**: The Fermi level – electron and hole concentrations at equilibrium – temperature dependence of carrier concentration.**Drift of carriers in electric**

field: conductivity and mobility – drift – effect of temperature and doping on mobility. (qualitative only)

UNIT-II: Excess Carriers in Semiconductors

Luminescence: Photoluminescence – Electroluminescence – Carrier Lifetime and Photoconductivity – direct recombination of electrons and holes – indirect recombination; trapping – photoconductivity devices – Diffusion of Carriers – diffusion processes – diffusion and drift of carriers; built-in field – diffusion and recombination –Diffusion length.

UNIT-III: **p-n junction diodes**

PN JUNCTION DIODES: P-N Junction Diode, Depletion region, Barrier Potential, Working in Forward and Reverse bias condition – Junction capacitance, Diode current equation– Effect of temperature on reverse saturation current – construction, working, V-I characteristics and simple applications of varactor diode, Zener diode and Tunnel diode.

UNIT-IV: Optoelectronic Devices

Photodiodes: Current and Voltage in an illumination junction – Solar Cells – Photodetectors - Light Emitting Diodes: Light – Emitting materials – Semiconductor Lasers: population inversion at a junction – Basic of Semiconductor Laser – materials for semiconductor Lasers.

UNIT-V:

Types of FET-Characteristics and Principles of operation of JFET -JFET as an amplifier- CS, CD, CG configuration-Operation of MOSFET as a switch – as a variable resistor – UJT-SCR and it's Characteristics

TEXT BOOKS:

1. Ben G Streetman and Sanjay Kumar Banerjee, "Solid State Electronics" 6thEdn PHI
   Unit I – Chapter 3 (relevant sections)
   Unit II – Chapter 4 (relevant sections)
   Unit IV – Chapter 8 (relevant sections)
2. Electronic Devices and Circuit Theory --- Robert L. Boylestad& Louis Nashelsky. 2.
3. Electronic Devices and Circuits I – T.L.Floyd- PHI Fifth Edition

BOOKS FOR REFERENCE:

1. S.Salivahanan, N. Suresh Kumar and A. Vallavaraj "Electronic divces and circuits" TMH(1998)
2. Millman and Halkias, "Electronics Devices and Circuicts"- McGraw Hill, V reprint 1993,
3. Boylestsd. L.Robert and Nashalsky Louis, "Electronic devices and Circuit theory", PHI 1997.

PAPER – II

APPLICATION OF ELECTRONICS DEVICES AND INSTRUMENTATION

UNIT- I:

DC indicating instruments- Galvanometer- Moving coil mechanism- Sensitivity and resolution – DC ammeter and voltmeter- Ohmmeter-Multimeters, DVM - AC indicating instruments-electrodynamometer- Moving iron and rectifier types - electrostatic voltmeter-Watt-hour meter, Principles and applications.

UNIT- II:

Oscilloscope – Basic operation – Detection and sensitivity - Principles of storage oscilloscope and sampling Oscilloscope. Use of oscilloscope in measurement of Waveform, frequency, phase difference - lock-in amplifier, frequency, response analyser.

UNIT- III:

Transducer and sensors: Classification of Transducers –Active, Passive transducers- Basic Requirements of Transducers- Strain gauge – Types of strain gauges-Operation of Strain gauge – Piezo electric pressure Transducers – thermistors- thermocouple- Resistive type thermometer- platinum resistance thermometer.

UNIT- IV:

Bio-potential Recorder: Characteristic recording system-Electrocardiography(ECG) Electroenchalograph(EEG)- Electromyograph(EMG)-Electroretinograph(ERG) and Electroculograph(EOG) – Ultrasound scanner.

UNIT- V:

Electrical Appliances: Refrigerator,air conditioner(both Window and Split), Home security System, CCTV, Vacuum Cleaner, Microwave Oven-Electric water heater - General principles and working.

BOOKS FOR STUDY/ REFERENCE

1. M. Arumugam – Biomedical instrumentation
2. A.K Sawhney –couse in electrical and electronic measurements and instruments
3. V.K Metha- Principles of Electronics
4. J.J Brophy – Basic electronics for Scientist
5. W.D. Cooper – Electronic instrumentation and measurements techniques.
6. C.S Rangan, V.S.T.V Mani and G.K Sharma – Instrumentation devises and system
7. S.Salivahanan. N.sureshkumar – Electronic devices and circuits
8. R.P Bali consumer Electronics Pearson Edition (2008)

PAPER-III

LINEAR INTEGRATED CIRCUITS

UNIT- I:

Operational Amplifier: Functional Block diagram- Characteristics of an ideal operational amplifier.**Operational Amplifier Characteristics:** Open loop gain-CMRR-offset current-Input and output offset voltages - Offset compensation techniques – frequency response characteristics – stability- limitation –Frequency compensation-Slew rate - transfer characteristics.

UNIT-II:

Application of Operational Amplifier I: Inverting and Non-Inverting amplifiers - voltage follower- Summing amplifier-Differential amplifier-Instrumentation amplifier-Integrator and Differentiator- Voltage to Current, Current to Voltage convertors.

UNIT-III:

Application of Operational amplifiers II: Sinusoidal oscillator-Active filter-Design of low pass - high pass - wide band pass - narrow band pass - notch and band stop filters.

UNIT-IV:

Application of Operational amplifiers III: Voltage regulator - Comparators- Zero crossing detector-Sample and hold circuit- Precision rectifier- Active peak detector - Clipper and Clamper - Logarithmic and Exponential amplifier.

UNIT-V:

IC 555 Timer: Timer functional block diagram and description –Monostable – Astable– bistableoperations – Voltage Controlled Oscillator – Digital to Analog convertor - Comparator – Voltage to Frequency convertor – Frequency to Voltage convertor.

BOOKS FOR STUDY/ REFERENCE

1. Gayawad A.R " OP-Amps and linear Integrated Circuits", Prentice Hall of India. Third Edition, New Delhi, 1993.
2. Coughlin F.R and Driscoll F.F " Operational Amplifiers and linear Integrated Circuits"PHI. III Ed, 1997.
3. Miliman and Halkias- McGrawHill.-Integrated Electrtonics-Analog and Digital circuits & System.
4. Roy Choudhury and shail Jain "linear Integrated Circuits".Wiley Eastern Ltd.1991.

PAPER – IV
ELECTRONIC COMMUNICATION

UNIT-I:

Introduction and block diagram of generalized communication system, role of each block viz. Information source, transmitter, channel/ communication media and receiver.Types of communication systems–simplex and duplex systems, analog and digital systems.Electromagnetic spectrum used in communication, concept of bandwidth.

UNIT-II:

Modulation - Need of modulation and types of modulation. Amplitude Modulution-Principle -mathematical expression- modulation index- percentage (%) modulation- side bands and frequency spectrum- power distribution. Concepts ofDSB, SSB & VSB.

UNIT-III:

Frequency Modulation – Principle - mathematical expression, modulation index, side bands.Comparison of AM and FM.**AM & FM Broadcast Transmitters** – Block diagram and working of each block.**Demodulation -** Amplitude demodulation (Diode detector), Frequency demodulation (Foster Seeley discriminator)

UNIT-IV:

Digital communication-baseband transmission and reception-digital carrier system-PCM, Delta modulation, generation and demodulation, Signal to Noise ratio - Digital modulation schemes-ASK, FSK, PSK, WDM(Qualitative Only)

UNIT-V:

(Block diagram approach only) **Microwave communication** – transmitter-receiver - repeater, Satellite communication-Optical fibre link, satellite system - Cellular radio system-**Global system for mobile(GSM)** – CDMA-GPRS-EDGE-Miscellaneous Mobile system

BOOKS FOR STUDY/ REFERENCE

1. Communication Electronics – Frenzel 3rd Edition (MGH)
2. Electronic Communication – Roddy&Colins (PHI)
3. Principles of Communication – Anokh Singh
4. W. Tomasi, Electronic Communication System, Pearson Education, Delhi, 2001
5. K.N.Hari Bhatt, Analog Communications, Sanguine Technical Publishers,2008
6. D. Patranabis, Telemetry principles, Tata McGraw Hill, New Delhi, 1999
7. Mobile Cellular Telecommunication William C.Y Lee-II Edition -2006 –TMH(Unit-V)

PRACTICAL – LABI
ELECTRONICS DEVICES AND CIRCUIT LAB

Any 12 experiments

1. Measurements of R,C,L
2. Measurements of R,C,L using bridge

3. Measurement of Voltage, Frequency, Period and Phase using CRO
4. Wave Shaping circuits
5. LDR characteristics
6. UJT characteristics
7. UJT Relaxation Oscillator
8. Load line analysis of transistor amplifier
9. LED and seven segment display
10. Photodiode characteristics
11. Bridge rectifier –Output characteristics and percentage of regulation
12. Constructions of RC low pass filter and its characteristics.
13. Constructions of RC high pass filter and its characteristics.
14. SCR Characteristics.
15. Zener diode Characteristic
16. Thermistor Characteristics – Temperature coefficient
17. Full wave rectifier with filter
18. Voltage Regular using IC – load characteristic
19. Voltage regulator using Zener diode – load characteristic

PRACTICAL - LAB-II

LINEAR AND DIGITAL ICS LAB

Any 12 experiments

1. Op-amp characteristics
2. Half Adder (using NOR and NAND gate only)
3. Half Subtractor(using NOR and NAND gate only)
4. Schmitt trigger using IC 741
5. Op-amp Oscillator
6. Logarithmic amplifier
7. Exponential amplifier
8. Low pass filter and High pass filter using Op-Amp
9. Study of Amplitude Modulation
10. Study of Frequency Modulation
11. Comparator and voltage follower using Op-Amp
12. 555 timer characteristics
13. Current to Voltage converter using op- amp
14. D-A converter using op- amp
15. Voltage Control Oscillator using 555 timer
16. Stain gauge Characteristic
17. MonostableMultivibrator
18. BistableMultivibrator
19. Saw tooth wave generation using 555 timer
20. Schmitt trigger using 555 timer
21. Voltage to Current convertor using IC 741