GOVERNMENT OF KARNATAKA

II PUC ELECTRONICS

THEORY SYLLABUS

1. Field Effect Transistor (FET) 2 Hrs

1.1 Field Effect Transistor (FET) Introduction, types, Junction field effect transistor (JFET) construction, working and characteristics. Definition of drain resistance r_d, transconductance g_m, amplification factor μ. Derivation of $\mu=r_d g_m$. Comparison of BJT and JFET, problems. **2 Hrs**

2. Bipolar Junction Transistor (BJT) Biasing 3 Hrs

2.1 Biasing : Introduction – Need for biasing. DC load line – end points of the load line from basic circuit in CE mode with two sources i.e. V_{BB} and V_{CC}. Equations for base current, collector current, V_{BE}, and V_{CE}. Significance, graph and problems.

Selection of operating point on DC load line. Mention the types of biasing – Fixed bias(base bias), Collector to base feedback bias, Emitter feedback bias and Voltage divider bias(universal bias).

Voltage divider bias: Circuit diagram, explanation, expressions for the end points of DC load line and for the coordinates of Q-point from approximate analysis. Importance of voltage divider bias, its advantages and problems on finding the coordinates of Q-point and marking on the load line. Leakage currents and thermal runaway. Derivation of stability factor S (S=), heat sink, problems. **3 Hrs**

3. Transistor Amplifiers 14 Hrs

3.1 Introduction to Amplifiers: Concept of amplification and faithful amplification – Biasing of EB junction and the CB junction for faithful amplification.

Classification of amplifiers based on different criterion: Based on position of the operating point, operating frequencies, bandwidth, number of stages, types of coupling and their application areas (qualitative treatment only).

Graphical representation of amplification in a transistor, small and large signals: Graph showing the DC load line on the output characteristics of a transistor, effect of choosing the Q-point near to saturation, near to cut off and

at the midpoint of the load line — to be discussed in brief for the small and large signals. **2 Hrs**

3.2 **Amplifier parameters:** Voltage gain, current gain, power gain, input and output impedances, bandwidth, half power frequencies. Expressions for power gain in dB and voltage gain in dB. Need for measurement of gain in dB. **1 Hr**

3.3 **Single stage CE, CB and CC amplifiers:** Circuit diagram using voltage divider bias, working, input, output waveforms, frequency response– Factors affecting the gain at low, midrange and high frequencies, 3dB bandwidth, applications.

3 Hrs

Comparative study of CE, CB and CC amplifiers (qualitative study): Comparison with respect to – input impedance, output impedance, phase relation between input and output voltages, voltage gain, current gain, frequency bandwidth and applications.

Common source JFET amplifier– circuit diagram, working and input, output wave forms. Problems.

3.4 **DC equivalent circuit:** Steps for drawing DC equivalent circuit. DC equivalent circuit of single stage CE amplifier with potential divider bias.

AC equivalent circuit of a single stage CE amplifier (potential divider bias) with r_e' model of transistor— steps involved in drawing ac equivalent circuit. Derivation of the expressions(neglecting the internal resistance of ac source) for current gain, voltage gain, input impedance, output impedance and power gain. Problems. **3 Hrs**

3.5 **Power amplifiers:** Introduction, classification, differences between voltage amplifier and power amplifier.
Class-B push-pull power amplifier – circuit diagram, working, power efficiency(mention only) and cross over distortion.
Class-C collector tuned power amplifier - circuit, working and power efficiency(mention only).
Comparison of efficiency and distortion of different power amplifiers.
Applications. **3 Hrs**

3.6 **Multistage amplifiers:** Need of multistage amplifier, gain of multistage amplifier, types of coupling with block diagrams.
Two stage RC coupled CE amplifier – Circuit diagram, working and frequency response. Qualitative study of gain at low, mid and high frequencies, advantages disadvantages and applications.

Direct-coupled CE amplifier – Circuit diagram, working and frequency response – qualitative study, advantages, disadvantages and applications.

Problems. **2 Hrs**

4. Feedback in Amplifiers 5 Hrs

4.1 Introduction to feedback –Need for feedback in amplifiers, block diagram illustrating the principle of feedback in amplifiers – feedback ratio, open loop gain, closed loop gain.

4.2 Positive and negative feedback- explanation, advantages, disadvantages and applications.

4.3 Block diagrams showing negative feedback -transfer functions, comparison of input and output impedances.

4.4 Voltage series negative feedback – Derivation of the expressions for voltage gain , stability in gain input and output impedances. Frequency response of negative feedback amplifier, expressions for bandwidth and cutoff frequencies, problems.

5. Operational amplifier (Op-Amp) 13 Hrs

5.1 Differential amplifier – Brief theory, transistorized circuit diagram showing the two input and output points-qualitative(mention the four modes). Dual input balanced output differential amplifier-working of common mode and differential mode- expressions for the gains-CMRR. Problems. **2 Hrs**

5.2 Operational Amplifier(op-amp) – Block diagram, circuit symbol, characteristics of ideal and practical op-amp(open loop gain, input and output impedances, bandwidth, CMRR, slew rate, input and output offset voltages). Mono, dual and quad op-amp ICs(mention only). **1 Hr**

5.3 Application of Op-Amp with negative feedback: Inverting Amplifier – Circuit diagram, explanation and derivation of the expression for voltage gain, Concept of virtual ground and virtual short. **2 Hrs**

Non-inverting Amplifier– Circuit diagram, working and derivation of the expression for voltage gain

Buffer Amplifier – Circuit diagram, working and derivation of the expression for voltage gain, its applications. Problems.

5.4 Summing amplifier: Three input inverting summing amp – Circuit diagram, working and derivation of the expression for the output voltage, adder.

Difference amplifier : Circuit diagram, working and derivation of the expression for the output voltage, subtractor. Problems. **2 Hrs**

5.5 Integrator and Differentiator: Basic circuits, working and derivations for output voltages, output wave forms for sine wave & square wave. Problems.

2 Hrs

5.6 Logarithmic and Antilogarithmic amplifiers: Circuit diagrams, working and applications **1 Hr**

5.7 **Active filters:** first order high pass and low pass filters – Circuit diagrams, working and frequency responses. Expressions for cut off frequency in each case. Problems **1 Hr**

5.8 **Digital to Analog Converter (DAC)** using R–2R ladder network and binary weighted resistors.

Analog to Digital Converter (ADC) using successive approximation converter.

Comparator and Schmitt trigger – Circuit diagrams, working, output waveforms and applications. **3 Hrs**

6. Oscillators 8 Hrs

6.1 **Introduction –** Electronic oscillators**,** sinusoidal and non sinusoidal oscillators. Sinusoidal oscillations – damped and un-damped oscillations.

Basic principle of an oscillator – positive feedback, review of the expression for voltage gain of a positive feedback amplifier(infinite gain). Block diagram– Barkhausen's criteria, startup of oscillations and start up condition. **2 Hrs**

6.2 **Classification of sinusoidal oscillators:** LC, RC and Crystal oscillators(mention the types of these). Damped oscillations in a tank circuit, losses.

Hartley and Colpitts oscillators – Circuits using transistor, working, Barkhausen conditions and expressions for the frequency of oscillations in each case. Advantages, disadvantages, applications, problems. **2 Hrs**

6.3 **RC oscillators**: Noise voltages as startup, principle of phase shift in RC circuits

Phase shift oscillator – phase shift network, principle, circuit using Op-amp, working, Barkhausen conditions, expression for the frequency of oscillations, problems.

Wein bridge oscillator – principle of lead-lag network, oscillator circuit using Op-Amp, working, Barkhausen conditions, expression for the frequency of oscillations, problems. Advantages of RC oscillators over LC oscillators, any two advantages of Wein bridge oscillator over Phase shift oscillator, applications of RC oscillators. **2 Hrs**

6.4 **Crystal oscillator –** Principle, equivalent circuit of a crystal. Colpitts oscillator circuit with inductance replaced by crystal, working, Barkhausen conditions, advantages of crystal oscillator over other types of oscillators and applications. **1 Hr**

6.5 Non-sinusoidal oscillator: Block diagram of IC 555, bistable multivibrator using IC 555, working. **1 Hr**

7. Wireless Communications 4 Hrs

7.1 Introduction to communication system, basic block diagram– function of each block, definitions of noise, signal to noise ratio and noise figure, significance of signal to noise ratio .Frequency of radio waves – various bands and applications. **1 Hr**

7.2 Propagation of radio waves: Introduction-various paths of propagation.

Troposphere – brief explanation and its utility in the propagation of radio waves.

Ground waves, ground reflected waves, space waves, sky waves – Qualitative study of each, concept of optical horizon and radio horizon. **1 Hr**

7.3 Ionosphere: Role of ionosphere in the process of long distance communication, different layers of ionosphere – height, thickness, constitution and operating frequency range. **1 Hr**

7.4 Sky waves: Mention the reflection mechanism with diagrammatic representation, definitions of the terms-critical frequency, critical angle, skip distance, skip zone, single hop and multiple hop distances, idea of signal fading. **1 Hr**

8. Modulation and Demodulation 15 Hrs

8.1 Modulation-definition, need, types of analog modulation, definition of each.

1 Hr

8.2 Amplitude modulation(AM) : Definition, explanation using waveform representation.

Modulation index: Definition, expressions, percentage modulation, representation of AM wave for different values of modulation index, importance, limitations. Problems. **1 Hr**

8.3 Derivation for the instantaneous voltage of an AM signal - frequency spectrum,

Power relations in AM signal: derivations for the interrelations between carrier power, side-band power and total power. Power dissipated in a load in terms of current. Problems. **2 Hrs**

8.4 Modulation by several sine waves. Explanation and expression for modulation index.

Other types of AM: SSBSC, SSBTC, DSBSC – Expressions for Power saved in each case. Transmission efficiency.

Applications of SSBSC transmission.Generation of AM signal: AM modulator, Types. Transistor collector modulator, circuit and working.
AM transmitter – block diagram, function of each stage with the wave form,

applications of AM transmission. Problems. **2 Hrs**

8.5 Frequency modulation (FM): Definition, representation of FM waveform. Definition of the terms frequency deviation, carrier swing, modulation index, percentage modulation, deviation ratio. Derivation for the instantaneous voltage of FM signal.

Features of Frequency spectrum of FM: Commercial FM broadcasting range, bandwidth expressions. Problems.FM modulator: Types. Varactor diode modulator, reactance modulator circuit diagram and working.

FM transmitter - block diagram with AFC – function of different stages, qualitative study of Pre-emphasis and De-emphasis. **2 Hrs**

8.6 Demodulation: Definition, need.

AM detection – principles of detection, linear diode detector-circuit, principle of working and waveforms. **2 Hrs**

FM detector – principle, Quadrature FM detector-circuit, working.

8.7 AM Superheterodyne Radio Receiver– Principle, block diagram, function of each stage with waveform, qualitative study of AGC.Reason for keeping oscillator frequency greater than signal frequency ($f_o > f_s$). Problems.

FM Superheterodyne Radio Receiver– Principle, block diagram, function of each stage with waveform, qualitative study of de-emphasis.

Characteristics of Radio receiver: Qualitative study of sensitivity, selectivity, signal to noise ratio, fidelity and stability. **2 Hrs**

8.8 Transmission lines: Introduction, equivalent circuit, definitions of the primary and secondary constants(L, C, R, G, Z & Y), applications. **1 Hr**

8.9 Antenna: Definition, qualitative study of helical, Yagi, loop, horn and micro strip antennas, applications. **1 Hr**

8.10 Digital communication: Introduction, comparison between analog and digital communication.

Block diagram of digital communication system. Function of each block. Application of digital communication. **1 Hr**

9. Power Electronics and its applications 12 Hrs

9.1 Power Electronics : Power semiconductor devices, Power diode, Power transistor, Silicon controlled rectifier (SCR), TRIAC, Power Metal Oxide Field Effect Transistor (MOSFET), Insulated Gate Bipolar Transistor(IGBT)- construction, operation, V-I characteristics for each device. Problems. **7 Hrs**

9.2 Applications of Power Electronics : Power converters, single phase AC to DC controlled rectifier, single phase fully controlled half wave rectifier and full wave rectifier using RC triggering circuit with R load, AC to AC converter (AC voltage controller), single phase full wave AC voltage controller using TRIAC, Lamp dimmer using TRIAC, DC to DC chopper using MOSFET, DC to AC inverter using IGBTs, gate drive circuit, pulse transformer isolation circuit, optocoupler isolation circuit, protection of power devices and power converters. Problems.

5 Hrs

10. Digital Electronics 16 Hrs

10.1 Exclusive OR(XOR) and Exclusive NOR(XNOR) gates – Logic symbols, Boolean expression for the outputs, truth tables, realization using basic logic gates and timing diagrams.

Universal property of NAND and NOR gates: Realisation of NOT, OR, AND, XOR and XNOR gates, Boolean expression for the output of each gate. Pin diagrams of IC 7400 and IC 7402. **2 Hrs**

10.2 Digital Codes: Introduction, need for Digital codes,– BCD codes (mention only), 8421 code (examples and applications), Self complimenting codes – Excess 3 code and 2421 code (examples and applications of each), Gray code (examples and applications), Binary to gray and gray to binary conversions using XOR gates (with logic circuits).

Alpha numeric codes: ASCII and EBCDIC codes, significance and applications. Problems. **2 Hrs**

10.3 Arithmetic Logic Circuits :Half Adder and Half subtractor – Logic symbols, realisation using X-OR gate and basic gates, explanation – Boolean expressions for the outputs, truth tables and timing diagrams.

Realisation of Half Adder using NAND gates – Boolean expressions for SUM and CARRY.

Full Adder: Logic symbol, explanation – SUM and CARRY outputs, Boolean expressions, truth table and timing diagrams.

Realisation of Full Adder using – i) two Half Adders and OR gate.ii) two X-OR gates, two AND gates and an OR gate.iii) three input X-OR gate and basic gates — Boolean expressions for SUM and CARRY outputs for all circuits, Application of Full Adder **3 Hrs**

10.4 Simplification of Boolean expressions: Conversion of Boolean expression to SOP form. Conversion of Boolean expression to POS form (mention only).

Karnaugh's map(K-map): Introduction, plotting K-map for two, three and four variables.Plotting the K-maps for the expressions of SOP form for four variables, pairs, quads, octets, don't care conditions-obtaining the simplified expressions. Realising the simplified expressions using – (i) only basic gates. and (ii) only NAND gates. Problems. **3 Hrs**

10.5 Sequential logic circuits: Introduction, importance of clock in digital circuits.Qualitative study of level triggering and edge triggering – positive edge triggering & negative edge triggering.

Flip Flops: Introduction,

Basic NAND latch, logic circuit, working and truth table.

Unclocked RS Flip Flop : Logic symbol, circuit using NAND gates only, working, timing diagrams and truth table.

Clocked RS Flip Flop : Logic symbol, circuits using NAND gates only, working, truth table and timing diagrams.

D Flip Flop: Logic symbol, RS Flip Flop as D Flip Flop – working, truth table and timing diagram.

JK Flip Flop: Logic symbol, realisation of JK Flip Flop using NAND gates, working, truth table, timing diagram and race around condition.

Master Slave JK Flip Flop : Logic circuit (using JK Flip Flop), working, truth table and timing diagram, advantages of MS JK Flip Flop.

T Flip Flop : Logic symbol, JK Flip Flop as T Flip Flop, working, truth table, timing diagram.

Applications of Flip–Flops. **3 Hrs**

10.6 Registers: Introduction, types of shift registers (4bit-serial-in serial-out, serial-in parallel-out, parallel-in serial-out, parallel-in parallel-out)- logic diagrams, operation, truth table, timing diagram and application. **2 Hrs**

10.7 Counters: Introduction, synchronous and asynchronous counters, their comparisons.

4 bit Synchronous up counter using JK Flip Flop, working, truth table and timing diagram. **1 Hr**

11. Microcontroller 10 Hrs

11.1 Microcontroller: Introduction, block diagram of microprocessor, block diagram of microcontroller, comparison between microprocessor & microcontroller and pin out diagram of 8051. **7 Hrs**

Addressing modes: Introduction, types, register addressing mode, immediate addressing mode, direct addressing mode, indirect addressing mode.

Instructions set – data transfer instructions, arithmetic instructions, jump and call instructions.

11.2 Assembly language programming(ALP) – addition, subtraction, multiplication, division – of two 8-bit numbers.

PIC microcontroller: Core feature and over view of series. **3 Hrs**

12. C – Programming 12 Hrs

12.1 C Introduction - Features, structure of a C program, C processor, the #include and #define directives, writing C programs, building an executable version of C program, examining and running a C application program.C program fundamentals: Character set, key words, identifiers, data types, constants and variables, statements, expressions, operators, precedence and associativity of operators, type conversion, managing input and output, C programs. **5 Hrs**

12.2 Selective control statement**s**–if statement, if-else statement, if-else-if statement, switch-case statement. Iterative control statements – while loop, do-while loop, for loop statement, break statement, continue statement, C programs. **3 Hrs**

12.3 Arrays – Introduction, one dimensional and two dimensional arrays, C programs. **2 Hrs**

12.4 C functions – Brief introduction, user defined and standard functions - <stdio.h> , <conio.h>, <math.h>, C programs. **2 Hrs**

13. Modern Communication Systems 6 Hrs

13.1 Cellular mobile Phone Network– Introduction, architecture, functions of various blocks.

Network operation: Frequency bands, Frequency reuse, call hand off, cell splitting, establishment of incoming and outgoing calls, types of cellular communication systems(GSM & CDMA). **2 Hrs**

13.2 Internet, Wi-Fi , Bluetooth and Optical fiber communications – principle, block diagrams and explanation.

Satellite Communication System – basic block diagram, function of each block, applications. **2 Hrs**

13.3 RADAR Communication System: Introduction, principle, basic block diagram, function of each block, frequency range, types, application. **2 Hrs**

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DEPARTMENT OF PRE UNIVERSITY EDUCATIONII PUC
PRACTICAL SYLLABUS IN ELECTRONICS

PERFORMANCE Experiments :

PART I

Sl.No.	Name of the experiment
01.	Common emitter amplifier – to study the frequency response and determine its bandwidth
02	Common base amplifier - to study the frequency response and determine its bandwidth.
03	Characteristics of common source n-channel JFET-determination of its parameters.
04	Op-amp inverting and non inverting amplifiers.
05	Op-amp adder and subractor - for two DC inputs only.
06	First order low-pass filter using op-amp - to study the frequency response and determine its cut-off frequency.
07	First order high-pass filter using op-amp - to study the frequency response and determine its cut-off frequency.
08	Colpitts oscillator using BJT.
09	Wein bridge oscillator using op-amp.

10 Phase shift oscillator using op-amp.

11 Realisation of AND, OR,NOT and XOR gates using IC 7400.

PART II

12 Realisation of AND, OR,NOT and XNOR gates using IC 7402.

13 Half adder and half subtractor using IC7400.

14 Clocked RS flip flop using IC 7400.

15 Verification of truth table of JK Flip-flop using IC 7476 and conversion of JK FF into T-FF.

16 Four bit ripple counter using IC 7476.

17 Assembly Language Programming for addition of two 8 bit numbers **(execution for a given program).**

18 Assembly Language Programming for multiplication of two 8 bit numbers **(execution for a given program).**

19 C program to find the roots of quadratic equation $ax^2 + bx + c = 0$. **(execution for a given program)**.

20 C program to find the product of two matrices of order 2 x 2 and 2 x 2. (**execution for a given program**).

21 SCR characteristics – for two values of I_G.

22 Full wave rectifier using SCR – by RC triggering method.

NOTE:

Any SEVEN (7) - experiments from **PART I** (no. 1 to 11) and **any SEVEN (7)** - experiments from **PART II** (no. 12 to 22) are compulsory.

Total 14 out of 22 experiments are compulsory from performance experiments.

PROJECTS :

Part I

Projects on analog and power electronics

1. Laboratory Function Generator
2. Battery Charger
3. Inverter Circuit

Part II

Projects on Microcontroller

4. I/O lines Programming
5. Interfacing Sensors
6. Interfacing 16X2 LCD Display

Part III

Project on PIC Microcontroller

7. Integrated Security System

*** Students are required to do at least one project from the above list.** However projects are not for evaluation in the practical examination.

Marks distribution in the PRACTICAL EXAMINATION.

In case of analog experiments

Sl. No.	Subject	Marks
1.	Circuit Diagram	3
2.	Constructing the circuit	3
3.	Tabular column and formula	2
4.	Performing the experiment	6
5.	Calculation and graph	4
6.	Result	2
7.	Record	6
8.	Viva Voce	4

In case of digital experiments

Sl. No.	Subject	Marks
1.	Pin Diagram	2
2.	Constructing the circuits	6
3.	Truth Table/s and Boolean expression/s	5
4.	Verification of the Truth Table/s	5
5.	Result	2
6.	Record	6
7.	Viva Voce	4

In case of C Programming & Microcontroller experiments

Sl. No.	Subject	Marks
1.	Entering the program	12

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2.	Finding the required value by feeding the given values	6
3.	Result	2
4.	Record	6
5.	Viva Voce	4

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