M Sc PHYSICS
FIRST SEMESTER EXAMINATION
MODEL QUESTION PAPER
PH1C04-ELECTRONICS

Time:3 hours Maximum weight:30

Part A
Answer six questions.
Short answer questions- weight 1 each

1) Draw the symbol and characteristics of an N - channel FET and mark linear region, saturation region and breakdown region.
2) Explain why open loop op-amp configurations are not used in linear applications.
3) Explain CMRR and slew rate of an op - amp.
4) What is the effect of negative feedback in non inverting amplifiers.
5) Draw the circuit of a differential input and differential output amplifier and write the expression for its gain.
6) What are instrumentation amplifiers. Draw the block diagram of an instrumentation system.
7) What are the advantages of active filters over passive filters.
8) What is a comparator?
9) What is the need for a low pass filter in PLL?
10) Of all frequencies that must be rejected by a superhetrodyne receiver, why is image frequency so important?

Part B
Answer four questions.
Problems - weight 2 each

11) For a given op – amp, CMRR = 100dB and differential gain = 10^5. Determine the common mode gain of op – amp.
12) Design a closed loop non – inverting amplifier circuit that is capable of providing a voltage gain of 10. Assume an ideal operational amplifier. Take the output for a load of 10 kΩ.(Values of the resistors should not exceed 30 kΩ). Draw the circuit and mark the components.
13) Draw the circuit of a low voltage ac voltmeter. Design a voltmeter to measure input voltages up to 2V using 1mA full - scale meter movement and 100 number of divisions.
14) Design a second order low – pass filter at a high cut off frequency of 1kHz and passband voltage gain of 1.586. Take the value of capacitance as 0.0047 μF and feedback resistor R_F = 15.82 kΩ. What changes will you make to get a new cut off frequency of 1.2kHz.
15) What is a current to voltage convertor. With a proper circuit, derive an expression for output voltage in terms of feedback resistance and input current. What is the output voltage for an input current of 10mA and a feedback resistance of 2 kΩ.
16) (a) The input signal of a voltage follower is $V_{in} = V_P \sin\omega t$. Show that the slew rate = $2\pi f V_P 10^{-6}$V/μs, where f is the input frequency.
(b) An inverting amplifier using the 741C must have flat response up to 40kHz. The gain of the amplifier is 10. What peak to peak input signal can be applied without distorting the output if the slew rate of 741C is 0.5 Volt/μs?

Part C
Answer all questions.
Essay – weight 4 each

17) (a)-(i) With a block diagram, explain voltage shunt feedback.
(ii) With necessary circuit and theory of non inverting amplifier with voltage shunt feedback, derive expressions for voltage gain and input resistance with feedback.

OR

(b) What is a differential amplifier? With a circuit and necessary theory, derive expressions for voltage gain and input resistances.

18) (a) Using inverting configuration of an op – amp, explain (i) summing amplifier (ii) scaling amplifier and (iii) averaging amplifier.

OR

(b) Explain an integrator and derive an expression for its output voltage. What modification will you make in the circuit to reduce error voltage. Explain it.

19) (a) Discuss with necessary theory, the working of a second order high pass filter.

OR

(b) Discuss the working of a voltage controlled oscillator.

20) (a) With necessary theory and circuit, explain the working of a astable multivibrator based on IC 555 timer.

OR

(b) Discuss the working of a communication receiver with a suitable block diagram.