BACHELOR OF SCIENCE EXAMINATION, 2018

(Final Year, 2nd Semester)

PHYSICS (HONOURS)

Electronics Devices and Circuit - II

Paper : HO - 14

Time : Two hours **Full Marks : 50**

Use separate Answer Script for each group

Group - A

Answer any *five* questions 5x5=25

1. (a) Draw the circuit diagram of emitter follower amplifier and find the expressions for current gain, input impedance and voltage gain.
   (b) Describe Darlington connection in CC-CC configuration 3+2

2. (a) Obtain voltage gain of an RC- coupled amplifier in high frequency range.
   (b) Mid frequency gain of an RC-coupled amplifier is 150. The gains of the amplifier are 50 at frequency 40 Hz and 60 at frequency 500 kHz. Find its bandwidth. 3+2

3. (a) Calculate the maximum efficiency of a Push-pull Class B power amplifier.
   (b) A Zener diode (5.6V, 400 mW) is used in a regulator circuit with maximum input voltage of 15V. Find the minimum value of series resistance that prevents the diode from being damaged. 3+2

4 (a) What is pinch-off voltage in a JFET? How it can be found out from mutual characteristic curve ?
   (b) Calculate drain current level of a JFET when the gate voltage V_{GS} is equal to one half of the pinch-off value (I_{DSS} = 16 mA). 3+2

5. (a) Find the expression for the frequency of oscillation of a Wien Bridge Oscillator.
   (b) Show that the voltage gain of the amplifier used in this oscillator must be greater than 3 . 3+2

6. (a) What are the advantages of negative feedback in amplifier? How is the bandwidth of an RC-coupled amplifier modified when negative feedback is used?
   (b) Nonlinear distortion in an amplifier is reduced from 10% to 1% , when 10% negative feedback is used. Find the voltage gain of the amplifier with feedback. 3+2

7. (a) Calculate frequency of oscillation of a Colpitts oscillator.
   (b) A certain Colpitts oscillator uses a tank circuit with L=20 mH, C_1 =200 pF and C_2=300 pF, What is the frequency of oscillation ? 3+2

GROUP - B (25 marks)

Modern Physics - III

Answer any *five* questions.

1. Consider a rectangular potential well of interaction between the neutron and the proton in a deutron atom given by the following form

$$V(r) = -V_0 \quad \text{for } r \leq b,$$
$$= 0 \ \& \ \text{for } r > b$$

where V_0 is the depth of the potential well and b is the radius of the well. Using scinrodinger equation for the deutron system find out depth of the potential V_0. [5]

2. The most successful postdictions between theory and observations of cosmic abundances that we probably do know correspond a great deal about the state of the Universe during the era spaning 1 to 10^3 sec. With the help of Wagonar diagram, briefly describe how the abundances of light elements produce during cosmic nucleosynthesis in this era. [5]

3. (a)The decay $\Xi^- \rightarrow \Lambda^0 + \pi^-$ is observed in nature whereas apparently similar decay $\Xi^- \rightarrow n^0 + \pi^-$ is never observed. Why ?
(b) A hadron is symbolized by $\Delta^{++}(\frac{3}{2}^+)$. Is it a fermion or a boson? What are its spin, parity, isospin, strangeness, and hypercharge ?
(c) Identify the interaction (strong, weak or electromagnetic) of the following decay
$K^+ \rightarrow \mu^+ + \pi^0 + \nu_\mu$, justify your answer. [2+2+1]

4. (a) Which particles correspond to quark composition $u\bar{s}, ddu, d\bar{s}, uds$? Which quarks make up the π^- pion and Ξ^- hyperon ?
(b) Check if the following reaction are allowed or forbidden.
(i) $p \rightarrow \pi^+ + \pi^- + e^-$ (ii) $\pi^+ + n \rightarrow \Lambda^0 + K^+$. [3+2]

5. a) "Transition from normal state to superconducting state is a second order phase transition" – Explain the statement.

b) What is Meissner effect? What is its conclusion?

[3+2]

6. What is Josephson's tunneling? Show that in Josephson junction if we apply dc source the produced current will be ac.

[1+4]

7. a) Describe briefly Joule-Thomson's effect.

b) What are the special properties of super fluid helium?

[3+2]