B. Sc. in EEE, 3rd Semester December 23, 2023 (**Afternoon**)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Semester Final Examination Winter Semester, A.Y. 2022-2023
Course No.: EEE 4303 Time: 180 Minutes
Course Title: Electronics II Full Marks: 150

There are 6 (**six**) questions. Answer all 6 (**six**) questions. The symbols have their usual meanings. Programmable calculators are not allowed. Marks of each question and corresponding COs and POs are written in the brackets. Do not write on this question paper.

1. a) Formulate the expression of output voltage for a non-inverting summing amplifier in case of three input voltages. **(12.5) (CO1) (PO1)**

b) Determine the equation of the closed-loop voltage gain, A_v of the T-feedback inverting amplifier shown in Fig. 1(b). **(12.5) (CO2) (PO2)**

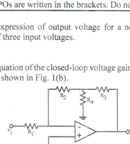

Fig. 1(b)

2. a) Sketch the Bode plots (magnitude & phase) for the transfer function, $H(\omega) = \frac{5(j\omega+2)}{j\omega(j\omega+10)}$. **(12.5) (CO1) (PO1)**

b) Explain the Bode plot in Fig. 2(b) and find the transfer function $H(\omega)$. **(12.5) (CO2) (PO2)**

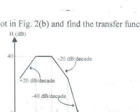

Fig. 2(b)

3. a) Sketch the circuit diagram of a unity gain amplifier and a precision half-wave rectifier circuit with its voltage transfer characteristics using op-amp. **(12.5) (CO1) (PO1)**

b) Design a two-pole high-pass Butterworth active filter with a cutoff frequency at f_{3dB} = 25 kHz and a unity gain magnitude at high frequency. Also determine the magnitude (in dB) of the gain at f = 25 kHz. **(12.5) (CO2) (PO2)**

4. a) The open-loop voltage gain of an amplifier is given by $A_v = \frac{10^5}{\left(1+j\frac{f}{10^3}\right)\left(1+j\frac{f}{10^5}\right)}$, if the low-frequency closed-loop gain is 100, is this amplifier stable? If so, determine the phase margin. **(12.5) (CO1) (PO1)**

b) A feedback amplifier has a low-frequency open-loop gain of 4000 and three poles at $f_{P1} = 400$ kHz, $f_{P2} = 4$ MHz, and $f_{P3} = 40$ MHz. A dominant pole is to be inserted such that the phase margin is 50 degrees. Assuming the original poles remain fixed, determine the dominant pole frequency. **(12.5) (CO2) (PO2)**

5. a) Explain the frequency of oscillation and the condition of oscillation of a Phase-Shift oscillator. **(12.5) (CO1) (PO1)**

b) Formulate the loop gain functions *T(s)*, the frequency of oscillation, and the R_2/R_1 required for oscillation for the circuit in Fig. 5(b). **(12.5) (CO2) (PO2)**

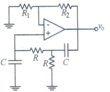

Fig. 5(b)

6. a) Explain the crossover distortion in class-B operation of an amplifier. **(12.5) (CO1) (PO1)**

b) Analyse the operation of a class-AB complementary BJT push–pull output stage. **(12.5) (CO2) (PO2)**