A voltage waveform $v_i = 10\sin(100\pi t)$ V is input to a full-wave rectifier with a load resistance of $R = 50$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Show** the circuit of the rectifier. **Label** the input and output voltages properly. [2]

(b) **Calculate** the DC value of the output voltage. [1]

(c) **Contrast** the value found in part (b) with that when a 5 μF capacitor is connected in parallel with the load. [2]

(d) **Identify** the two diodes will be ON in the positive half cycle. [1]

Now the two diodes from part (d) are replaced with Germanium diodes [$V_{D_0} = 0.2$ V].

(e) **Explain** the change in the voltage transfer characteristics and output voltage waveform of the circuit. Hence, calculate the peak of the output voltage in this case. [3+1]

A voltage waveform $v_i = 5\sin(200\pi t)$ V is fed into a Full-wave rectifier with a load resistor, $R = 5$ kΩ. Silicon diodes are used in this circuit where, $V_{D_0} = 0.6$ V.

(a) **Draw** the rectifier circuit. **Label** the input and output voltages properly. Briefly **explain** the application of the circuit. [1+1+1]

(b) **Calculate** the DC value of the output voltage, V_{dc} and the output frequency, f_o. [1+1]

(c) **Draw** the Voltage Transfer Characteristics (VTC) of the Full-wave rectifier and **label** it properly. [2]

(d) Now, you have to connect a capacitor in parallel with the load resistor. You have two capacitors of 5 μF and 1 μF at your disposal. Which capacitor will you use? **Explain** briefly with necessary calculations. [3]

(e) **[Bonus]** A different input waveform is fed into the Full-wave rectifier. The new peak-to-peak ripple voltage is 50% of the previous one calculated from (d) with the 5 μF capacitor. The new output frequency is 300 Hz. **Determine** the equation of the input waveform. [2]

A voltage waveform $v_i = 10\sin(1000\pi t)$ V is fed into a full-wave (FW) rectifier with a load resistance $R = 10$ kΩ. A capacitor is also connected in parallel with the load to reduce the fluctuation of the output voltage. It produces a peak-to-peak ripple voltage which is **3%** of the peak output voltage. The diodes have a forward voltage drop of $V_{D_0} = 0.8$ V.

(d) **Deduce** the peak output voltage, V_p, and the peak-to-peak ripple voltage, $v_{r(p-p)}$. [2]

(e) **Calculate** the average (DC) value of the output voltage. [1]

(f) **Estimate** the value of the capacitor from the given data. [2]

Now the input voltage v_i is changed to the one shown in Figure (ii) and the **capacitor is removed**.

(g) **Show** the output waveform and **indicate** the voltage levels properly. [2]