(Affiliated to University of Mumbai)	***End Semester Examination (R-24/R-25) SH 2026 Answer Key with marking scheme***
Branch: ECS	Course: Electronic Devices and Circuits
Year/ Semester: III	Course code: ECC304
Time: 02 hours	Marks: 60

		Marks
Q. 1	All questions are compulsory.	**30**
A.	Definition and working principle [2M] Neat and labelled diagram and characteristics [2M] Applications [1M]	05
B.	Diagram and description-Inductor filter [2.5M] Diagram and description-Capacitor filter [2.5M]	05
C.	Stability factor [2M] Expression of S for fixed bias [3M]	05
D.	Diagram, working-[4M] Waveforms [1M]	05
E.	Valid five comparison points[5M]	05
F.	Diagram [2M] Equations [3M]	05
Q.2A	Working principle of Zener diode [2M] Circuit diagram [1M] Explanation of types of voltage regulation [2M]	5
	OR	
Q.2B.	Characteristics [2M] Explanation [3M]	5
Q.3A	Circuit identification [1M] Working principle [2M] Diagram [2M]	5
	OR	
Q.3B	Types of power amplifiers [2M] diagram and explanation [3M]	5
Q.4A	Explanation and hybrid-π equivalent circuit [3M] Derivation of input and output impedance [2M] Derivation of voltage gain [2.5M] Derivation of current gain and final expressions [2.5M]	10
	OR	
Q.4B	Circuit diagram [3M] Derivation of base current and collector current [3M] Derivation of collector-emitter voltage V_{CE} [2M] Derivation of stability factor S [2M]	10
Q.5A	Explanation and small-signal equivalent circuit [3M] Derivation of input impedance [2M] Derivation of output impedance [2M]	10

	Derivation of voltage gain [3M]	
	OR	
Q.5B	**1. Gate voltage** Since $I_G \approx 0$, $V_G = V_{DD}\frac{R_2}{R_1 + R_2}$ $V_G = 40\frac{18}{22 + 18} = 18\,V$ **2. Find k** For an enhancement MOSFET, $I_D = k(V_{GS} - V_{GS(th)})^2$ Using $I_D = 3\,mA$ at $V_{GS} = 10\,V$: $3 = k(10 - 5)^2$ $k = 0.12\,mA/V^2$ **4. Calculate V_{GSQ}** $V_{GSQ} = 18 - (6.7)(0.82)$ $V_{GSQ} \approx 12.5\,V$ **5. Calculate V_{DSQ}** $V_{DS} = V_{DD} - I_D(R_D + R_S)$ $V_{DS} = 40 - (6.7)(3 + 0.82)$ $V_{DSQ} \approx 14.4\,V$ **Final answers** $I_{DQ} \approx 6.7\,mA$ $V_{GSQ} \approx 12.5\,V$ $V_{DSQ} \approx 14.4\,V$ **3. Relate V_{GS} to I_D** The source voltage is $V_S = I_D R_S$ so $V_{GS} = V_G - V_S$ $V_{GS} = 18 - 0.82I_D$ (I_D in mA.) Substitute into the MOSFET equation: $I_D = 0.12[(18 - 0.82I_D) - 5]^2$ $I_D = 0.12(13 - 0.82I_D)^2$ Solving gives the physically applicable root: $I_{DQ} \approx 6.7\,mA$ Stepwise solution mandatory [1M], I_{DQ} [3M], V_{GSQ} [3M], V_{DS} [3M]	
	*********** All the Best***********	