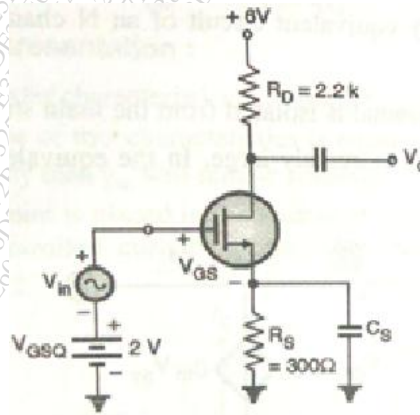


(3 Hours)

[Total Marks: 80]

- N.B:** (1) Question No.1 is compulsory.  
(2) Solves any three out of remaining question.  
(3) Assume suitable data if necessary.

- Q.1** Solve any Four
- a. Draw characteristics of PN junction in thermal equilibrium and explain. **05**
  - b. For a BJT amplifier, show with the help of a voltage divider bias circuit, how to draw A.C. load line? Draw graph. **05**
  - c. Explain the operation of MOSFET as amplifier. **05**
  - d. Explain construction, working principle and characteristics of Photodiode. **05**
  - e. Compare HWR, FWR and Bridge rectifier. **05**
- Q.2**
- a. Draw and explain positive and negative clamper circuit. **10**
  - b. Explain common base configuration of BJT as an Amplifier. **10**
- Q.3**
- a. Draw and explain VI and CV characteristics of P-channel enhancement type MOSFET with symbol. **10**
  - b. Explain operation and characteristics of Schottkey diode. **10**
- Q.4**
- a. Explain the operation of fullwave rectifier and draw the output waveform for  $V_{Ldc}$  and  $I_{Ldc}$ . **10**
  - b. Explain working of BJT considering all possible current density components in an NPN transistor operation in active mode. **10**
- Q.5**
- a. Design single stage RC coupled amplifier to give a voltage gain of 80 with stability factor better than 11 and output voltage of 3 Vrms. **15**  
Use NPN transistor with specifications  
 $h_{fe} = 110-800$ ,  $h_{ie} = 4.5 \text{ k}\Omega$ ,  $V_{CE} = 45 \text{ V}$ ,  
 $I_{C(max)} = 100 \text{ mA}$ ,  $f_L = 300\text{Hz}$ ,  $V_{CC} = 18\text{V}$ .
  - b. Draw small signal model of PN junction diode. What is the main use of this model? **05**
- Q.6**
- a. What is the small signal voltage gain of the MOSFET amplifier shown in diagram, if  $V_T = 1 \text{ V}$ ,  $K = 0.82\text{mA/V}^2$  and  $\lambda = 0.022/\text{V}$ . **10**



- b. Explain hybrid model of BJT. **10**

DBEC DATA SHEET

Transistor type	P <sub>dm</sub> max @ 25°C Watts	I <sub>cm</sub> max @ 25°C Amps	V <sub>ce(sat)</sub> volts d.c.	V <sub>ceo</sub> volts d.c.	V <sub>ceo</sub> (SUS) volts d.c.	V <sub>ce</sub> (SUS) volts d.c.	V <sub>ce</sub> volts d.c.	V <sub>ceo</sub> volts d.c.	T <sub>j</sub> max °C	D.C. current		gain		Small Signal		h <sub>fe</sub> max.	V <sub>ce</sub> max.	θ <sub>jc</sub> °C/W	Derate above 25°C W/°C
										min	typ.	min.	max.	min.	typ.				
2N 3055	115.5	15.0	1.1	100	60	70	90	7	200	20	50	70	15	50	120	1.8	1.5	0.7	
ECN 055	50.0	5.0	1.0	60	50	55	60	5	200	25	50	100	25	75	125	1.5	3.5	0.4	
ECN 149	30.0	4.0	1.0	50	40	—	—	8	150	30	50	110	33	60	115	1.2	4.0	0.3	
ECN 100	5.0	0.7	0.6	70	60	65	—	6	200	50	90	280	50	90	280	0.9	35	0.05	
BCE147A	0.25	0.1	0.25	50	45	50	—	6	125	115	180	220	125	220	260	—	—	—	
2N 525(PNP)	0.225	0.5	0.25	85	30	—	—	—	100	35	—	65	—	45	—	—	—	—	
BCE147B	0.25	0.1	0.25	50	45	50	—	6	125	200	290	450	240	330	500	0.9	—	—	

Transistor type	h <sub>ie</sub>	h <sub>oe</sub>	h <sub>re</sub>	β <sub>ia</sub>
BC 147A	2.7 K Ω	18 μ Ω	1.5 × 10 <sup>-4</sup>	0.4°C/mw
2N 525 (PNP)	1.4 K Ω	25 μ Ω	3.2 × 10 <sup>-4</sup>	—
BC 147B	4.5 K Ω	30 μ Ω	2 × 10 <sup>-4</sup>	0.4°C/mw
ECN 100	50 Ω	—	—	—
ECN 149	15 Ω	—	—	—
ECN 055	12 Ω	—	—	—
2N 3055	6 Ω	—	—	—

BFW 11—JFET MUTUAL CHARACTERISTICS													
-V <sub>GS</sub> volts	I <sub>DS</sub> max. mA	I <sub>DS</sub> typ. mA	I <sub>DS</sub> min. mA	g <sub>fs</sub>	g <sub>ms</sub>	g <sub>os</sub>	r <sub>ds</sub>	r <sub>gs</sub>	r <sub>gs</sub>				
										0.0	0.2	0.4	0.6
0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.6	2.0	2.4	2.5	3.0	3.5	4.0
10	9.0	8.3	7.6	6.8	6.1	5.4	4.2	3.1	2.2	2.0	1.1	0.5	0.0
7.0	6.0	5.4	4.6	4.0	3.3	2.7	1.7	0.8	0.2	0.0	0.0	0.0	0.0
4.0	3.0	2.2	1.6	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

N-Channel JFET											
Type	V <sub>GS</sub> max. Volts	V <sub>DS</sub> max. Volts	V <sub>GS</sub> max. Volts	P <sub>D</sub> max. @25°C	T <sub>J</sub> max.	I <sub>DS</sub>	g <sub>fs</sub> (typical)	-V <sub>P</sub> Volts	r <sub>ds</sub>	Derate above 25°C	θ <sub>jc</sub>
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ Ω	6	50 K Ω	2 mW/°C	0.59°C/mw
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ Ω	2.5	50 K Ω	—	0.59°C/mw