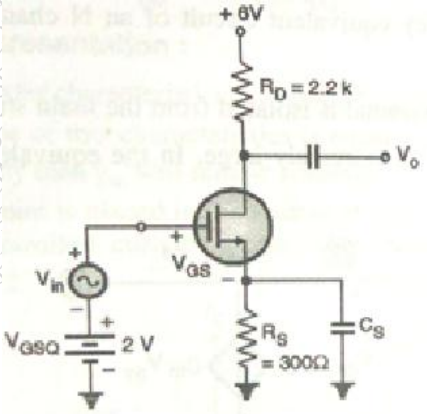
(3 Hours) **[Total Marks: 80]**

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. Use NPN transistor with specifications h_{fe} – 110-800, h_{ie} =4.5 kΩ, V_{CE}=45 V, $I_{c(max)}$ =100 mA, f_L=300Hz, V_{CC} = 18V.	**15**
	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 V, K = 0.82mA/V^2 and λ = 0.022/V. 	**10**
	b.	Explain hybrid model of BJT.	**10**

DBEC DATA SHEET

Transistor type	P_{dmax} @ 25°C Watts	I_{cmax} @ 25°C Amps	V_{CE} (sat) volts d.c.	V_{CBO} volts d.c.	V_{CEO} (Sus) volts d.c.	V_{CER} (Sus) volts d.c.	V_{CEX} volts d.c.	V_{BEO} volts d.c.	T_j max °C	D.C. current gain min.	typ.	max.	Small Signal h_{fe} min.	typ.	max.	V_{BE} max.	θ_{jc} °C/W	Derate above 25°C W/°C
2N 3055	115·5	15·0	1·1	100	70	90	60	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
BC147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9	—	—
2N 525(PNP)	0·225	0·5	0·25	85	30	—	—	—	100	35	—	65	—	45	—	—	—	—
BC147B	0·25	0·1	0·25	50	45	50	—	6	125	200	290	450	240	330	500	0·9	—	—

Transistor type	hie	hoe	hre	θja
BC 147A	2·7 K Ω	18μ ℧	1·5 × 10⁻⁴	0·4°C/mw
2N 525 (PNP)	1·4 K Ω	25μ ℧	3·2 × 10⁻⁴	—
BC 147B	4·5 K Ω	30μ ℧	2 × 10⁻⁴	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

–Vgs volts	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
Ids max. mA	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
Ids typ. mA	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
Ids min. mA	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_{ds} max. Volts	V_{DG} max. Volts	V_{GS} max. Volts	P_d max. @25°C	T_j max.	I_{DSS}	g_{fs} (typical)	$-V_p$ Volts	r_d	Derate above 25°C	θ_{ja}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ ℧	6	50 KΩ	2 mW/°C	0·59°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ ℧	2·5	50 KΩ	——	0·59° C/mW