SOME PRACTICE QUESTIONS FOR H138A MID TERM EXAM

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$$\%reg = \frac{V_{no\ load} - V_{full\ load}}{V_{full\ load}} \times 100$$

$$\Delta V_Z = Z_{ZT} \times \Delta I_Z$$

$$P = V \times I$$

$$\%eff = \frac{P_{out}}{P_{in}} \times \frac{100}{1}$$

$$A_V = 1 + \frac{R_F}{R_{in}} \quad \text{(non-inverting opamp)}$$

$$V(load) = V(ref) \times \frac{Ra+Rb}{Rb}$$

$$V(load) = V(ref) \times \frac{Rb}{Ra+Rb}$$

} **Where Ra = top divider resistor**
} **Rb = bottom divider resistor**

$$V(load) = Vin \times \frac{Ton}{T} \qquad T = \frac{1}{f} \ \& \ T = ton + toff$$

$$V(load) = Vin \times \frac{T}{toff} \qquad V(load) = -Vin \times \frac{ton}{toff}$$

$$V(load) = I(load) \times RL V(load) = 1.25(1 + \frac{R2}{R1})$$

$$I(\text{limit}) = \frac{0.7V}{R(sense)} \qquad I(\text{limit}) = \frac{0.2V}{R(sense)}$$

$$I_B = \frac{I_E}{\beta} \qquad I(ref) = \frac{V(in) - V(ref)}{Rs}$$

$$\text{Ripple reduction factor (RRF)} = \frac{V(ripple)in}{V(ripple)out}$$

$$\%\ \text{Load Regulation} = \frac{\text{V(no load) - V(full load)}}{\text{V(full load)}} \times 100$$

$$\text{Line Regulation} = \frac{[\text{V(out high) - V(out low)}] \times 100}{\frac{\text{V(out nominal)}}{\{\text{V(line high) - V(line low)}\}}} \quad (\%/V)$$

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1. The purpose of a voltage regulator in a power supply is to:
(a) ensure Vo does not vary with load variation
(b) ensure Vout does not vary with input voltage variation
(c) keep Vout steady with minimum power dissipation
(d) all of the above

2. A zener regulator is required to give 15 V and handle the power generated by a 120 mA current.The maximum power dissipation rating for the diode must be:
(a) 180 mW
(b) 1.5 W
(c) 2 W
(d) 18 W

ZENER VOLTAGE REGULATORS

Power Rating	400mW		400mW		500mW		1W	
Max. Op. Temp. (°C)	175		175		200		200	
Tolerance (%)	5		5		5		5,10	
Notes	(4)		(4)		(4)		(5)	
Case Style	DO-7/DO-35		DO-7/DO-35		DO-7/DO-35		DO-204AL	
Nominal Vz	Part No.	Izt (mA)	Part No.	Izt (mA)	Part No.	Izt (mA)	Part No.	Izt (mA)
3.3	1N746A	20	–	–	1N5226B	20	1N4728A	76
3.6	1N747A	20	–	–	1N5227B	20	1N4729A	69
3.9	1N748A	20	–	–	1N5228B	20	1N4730A	64
4.3	1N749A	20	–	–	1N5229B	20	1N4731A	58
4.7	1N750A	20	–	–	1N5230B	20	1N4732A	53
5.1	1N751A	20	–	–	1N5231B	20	1N4733A	49
5.6	1N752A	20	–	–	1N5232B	20	1N4734A	45
6.0	–	–	–	–	1N5233B	20	–	–
6.2	1N753A	20	–	–	1N5234B	20	1N4735A	41
6.8	1N754A	20	1N957B	18.5	1N5235B	20	1N4736A	37
7.5	1N755A	20	1N958B	16.5	1N5236B	20	1N4737A	34
8.2	1N756A	20	1N959B	15.0	1N5237B	20	–	–
8.7	–	–	–	–	1N5238B	20	–	–
9.1	1N757A	20	1N960B	14.0	1N5239B	20	–	–
10	1N758A	20	1N961B	12.5	1N5240B	20	–	–
11	–	–	1N962B	11.5	1N5241B	20	–	–
12	1N759A	20	1N963B	10.5	1N5242B	20	–	–
13	–	–	1N964B	9.5	1N5243B	9.5	–	–
14	–	–	–	–	1N5244B	9.0	–	–
15	–	–	1N965B	8.5	1N5245B	8.5	–	–
16	–	–	1N966B	7.8	1N5246B	7.8	–	–
17	–	–	–	–	1N5247B	7.4	–	–
18	–	–	1N967B	7.0	1N5248B	7.0	–	–
19	–	–	–	–	1N5249B	6.6	–	–
20	–	–	1N968B	6.2	1N5250B	6.2	–	–
22	–	–	1N969B	6.2	1N5251B	5.6	–	–
24	–	–	1N970B	5.2	1N5252B	5.2	–	–
25	–	–	–	–	1N5253B	5.0	–	–
27	–	–	1N971B	4.6	1N5254B	4.6	–	–
28	–	–	–	–	1N5255B	4.5	–	–
30	–	–	1N972B	4.2	1N5256B	4.2	–	–
33	–	–	1N973B	3.8	1N5257B	3.8	–	–
36	–	–	1N974B	3.4	1N5258B	3.4	–	–
39	–	–	1N975B	3.2	1N5259B	3.2	–	–
43	–	–	1N976B	3.0	1N5260B	3.0	–	–
47	–	–	1N977B	2.7	1N5261B	2.7	–	–
51	–	–	1N978B	2.5	1N5262B	2.5	–	–
56	–	–	1N979B	2.2	1N5263B	2.2	–	–
60	–	–	–	–	1N5264B	2.1	–	–
62	–	–	1N980B	2.0	1N5265B	2.0	–	–
68	–	–	1N981B	1.8	1N5266B	1.8	–	–
Data Sheet (PD-)	1.002		1.002		1.003		1.006	

Table 3.1

3. A zener diode has a power dissipation rating of 500 mW and a voltage rating of 8.2 V. What is the maximum current rating (Izm) for the diode?
(a) 60.9 mA
(b) 6.09 mA
(c) 609 microA
(d) 60.9 microA

4. A zener diode is required to provide 12 V and the Izt rating is 80 mA. From Tables 3.1 and 3.2, select the diode you would use:
(a) 1N1759A
(b) 1N5349B
(c) 1N4742A
(d) 1N5242B

Power Rating	1W		1W		5W		10W		50W	
Max. Op. Temp. (ºC)	175		200		175		175		175	
Tolerance (%)			5, 10							
Notes	(4)†		(5)		(4)		(6)†		(6)	
Case Style	DO-13		DO-204AL		C-12		DO-4		C-8	
Nominal V_z	Part No.	I_{zt} (mA)	Part No.	I_{zt} (mA)	Part No.	I_{zt} (mA)	Part No.	I_{zt} (mA)	Part No.	I_{zt} (mA)
	Part Number									
8.2	1N3018B†	31	1N4738A	31	1N5344B	150	1N2972B†	305	1N3307B	1500
8.7	–	–	–	–	1N5345B	150	–	–	–	–
9.1	1N3019B†	28	1N4739A	28	1N5346B	150	1N2973B†	275	1N3308B	1370
10	1N3020B†	25	1N4740A	25	1N5347B	125	1N2974B†	250	1N3309B	1200
11	1N3021B†	23	1N4741A	23	1N5348B	125	1N2975B†	230	1N3310B	1100
12	1N3022B†	21	1N4742A	21	1N5349B	100	1N2976B†	210	1N3311B	1000
13	1N3023B†	19	1N4743A	19	1N5350B	100	1N2977B†	190	1N3312B	960
14	–	–	–	–	1N5351B	100	1N2978B†	180	1N3313B	890
15	1N3024B†	17	1N4744A	17	1N5352B	75	1N2979B†	170	1N3314B	830
16	1N3025B†	15.5	1N4745A	15.5	1N5353B	75	1N2980B†	155	1N3315B	780
17	–	–	–	–	1N5354B	70	1N2981B†	145	1N3316B	740
18	1N3026B†	14.0	1N4746A	14.0	1N5355B	65	1N2982B†	140	1N3317B	700
19	–	–	–	–	1N5356B	65	1N2983B†	130	1N3318B	660
20	1N3027B†	12.5	1N4747A	12.5	1N5357B	65	1N2984B†	125	1N3319B	630
22	1N3028B†	11.5	1N4748A	11.5	1N5358B	50	1N2985B†	115	1N3320B	570
24	1N3029B†	10.5	1N4749A	10.5	1N5359B	50	1N2986B†	105	1N3321B	520
25	–	–	–	–	1N5360B	50	1N2987B†	100	1N3322B	500
27	1N3030B†	9.5	1N4750A	9.5	1N5361B	50	1N2988B†	95	1N3323B	460
28	–	.	–	–	1N5362B	50	–	–	–	–
30	1N3031B†	8.5	1N4751A	8.5	1N5363B	40	1N2989B†	85	1N3324B	420
33	1N3032B†	7.5	1N4752A	7.5	1N5364B	40	1N2990B†	85	1N3325B	380
36	1N3033B†	7.0	1N4753A	7.0	1N5365B	30	1N2291B†	70	1N3326B	350
39	1N3034B†	6.5	1N4754A	6.5	1N5366B	30	1N2992B†	65	1N3327B	320
43	1N3035B†	6.0	1N4755A	6.0	1N5367B	30	1N2993B†	60	1N3328B	290
45	–	–	–	–	–	–	1N2994B†	55	1N3329B	280
47	1N3036B†	5.5	1B4756A	5.5	1N5368B	25	1N2995B†	55	1N3330B	270
50	–	–	–	–	–	–	1N2996B	50	1N3331B	250
51	1N3037B†	5.0	1N4757A	5.0	1N5369B	25	1N2997B†	50	1N3332B	245
52	–	–	–	–	–	–	1N2998B	50	1N3333B	240
56	1N3038B†	4.5	1N4758A	4.5	1N5370B	20	1N2999B†	45	1N3334B	220
60	–	–	–	–	1N5371B	20	1N2999B†	–	–	–
62	1N3039B†	4.0	1N4759A	4.0	1N5372B	20	1N3000B†	40	1N3335B	200
68	1N3040B†	3.7	1N4760A	3.7	1N5373B	20	1N3001B†	37	1N3336B	180
75	1N3041B†	3.3	1N4761A	3.3	1N5374B	15	1N3002B†	33	1N3337B	170
82	1N3042B†	3.0	1N4762A	3.0	1N5375B	15	1N3003B†	30	1N3338B	150
87	–	–	–	–	1N5376B	15	–	–	–	–
91	1N3043B†	2.8	1N4763A	2.8	1N5377B	15	1N3004B†	28	1N3339B	140
100	1N3044B†	2.5	1N4764A	2.5	1N5378B	15	1N3005B	25	1N3340B	120
Data Sheet (PD-)	1.004		1.005		1.008		1.009		1.013	

5. A simple series pass one transistor NPN regulator has an input voltage of 16 V DC. If the reference base
zener diode is 12 V, the output voltage level is approximately:
(a) 11.4 V
(b) 12.0 V
(c) 12.6 V
(d) 15.4 V

6. If the load current is 1 A for the circuit in question 5, the transistor power dissipation will be approximately:
(a) 600 mW
(b) 4.0 W
(c) 4.6 W
(d) 11.4 W

7. The percentage efficiency of the circuit discussed in questions 5 and 6 will be approximately:
(a) 40%
(b) 50%
(c) 60%
(d) 70%

8. Refer to Figure 3.12 . The output current is limited to:
(a) 1.2A
(b) 0.6A
(c) 1.8A
(d) 1A

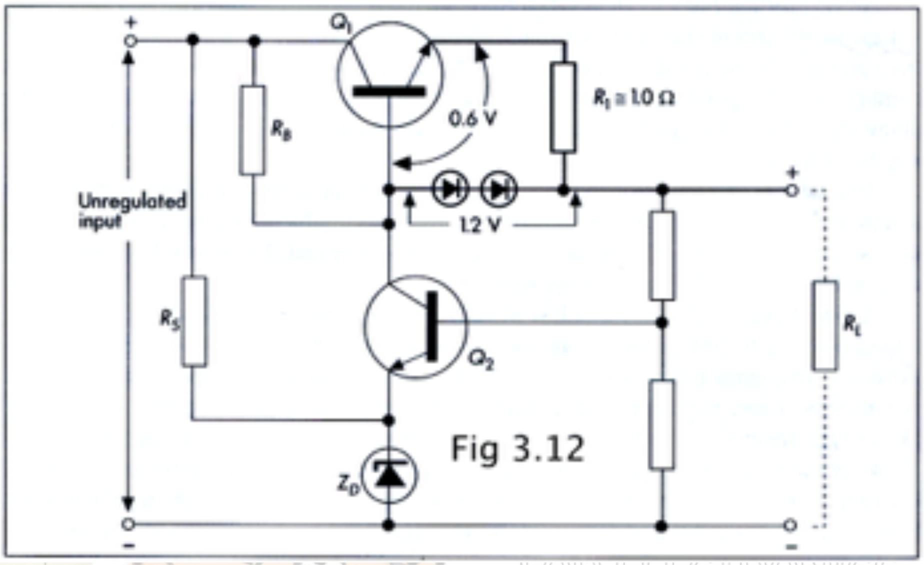


Fig 3.12

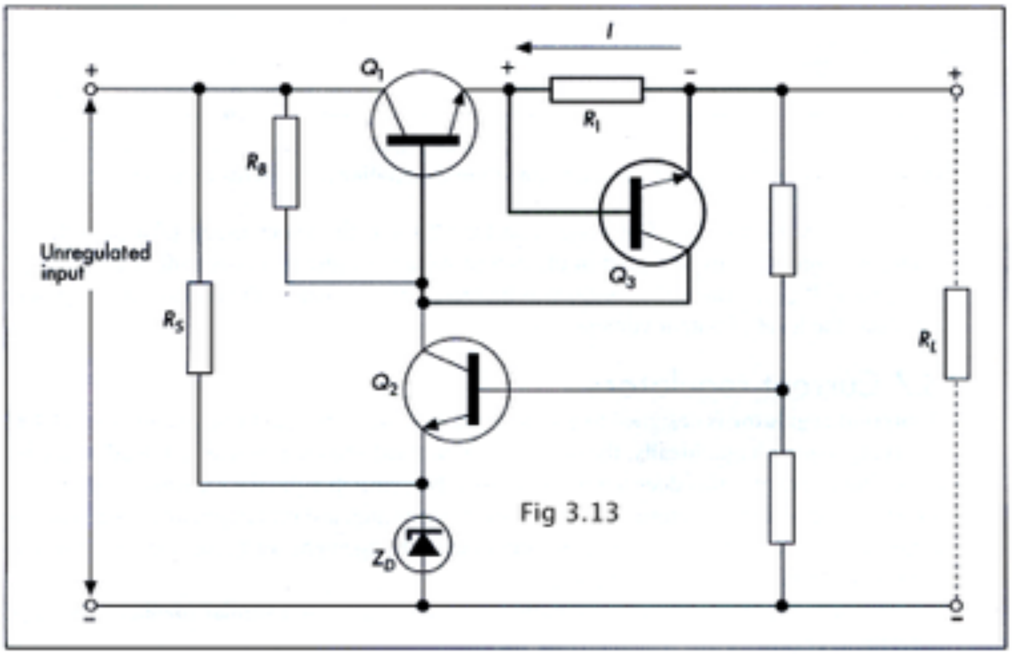


Fig 3.13

9. Refer to Figure 3.13 . If the output current is to be limited to 750 mA, the value of current sensing resistor (R1) required is:
(a) R75
(b) R8
(c) IR
(d) 1R5

10. Refer to figure 3.13, If the base was to open circuit on Q2, what will the output voltage be if the unregulated input was 14V and the zener was 9V?
(a) 8.4V
(b) 13.4V
(c) No output voltage
(d) Indeterminate

11. Refer to figure 3.13, If the resistor between Q2 base and the negative rail was to open circuit, the output voltage of the power supply would be (14 Volts unregulated input and zener is 9V):
(a) 8.4V
(b) 13.4V
(c) No output voltage
(d) Indeterminate

12. Refer to figure 3.13, If Rs was to open circuit, the output voltage of the power supply would be (14 Volts unregulated input and zener is 9V):
(a) 8.4V
(b) 13.4V
(c) No output voltage
(d) Indeterminate

13. Refer to figure 3.13, If Zd was to become short circuit, the output voltage of the power supply would become (14 Volts unregulated input and zener is 9V):
(a) 8.4V
(b) 13.4V
(c) No output voltage
(d) Indeterminate

14. Refer to figure 3.13, If Zd was to become open circuit, the output voltage of the power supply would become (14 Volts unregulated input and zener is 9V):
(a) 8.4V
(b) 13.4V
(c) No output voltage
(d) Indeterminate

15. Refer to Figure 3.11. If the value of the load resistor decreases, the bias voltages of Q1 and Q2 respectively will:
Q1 Q2
(a) decrease decrease
(b) increase increase
(c) increase decrease
(d) decrease increase

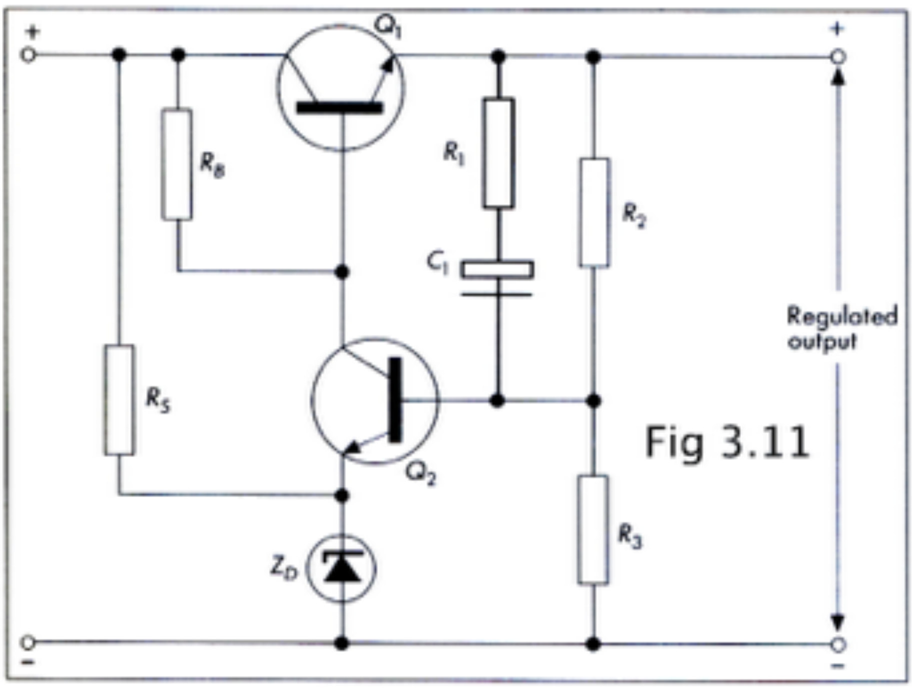
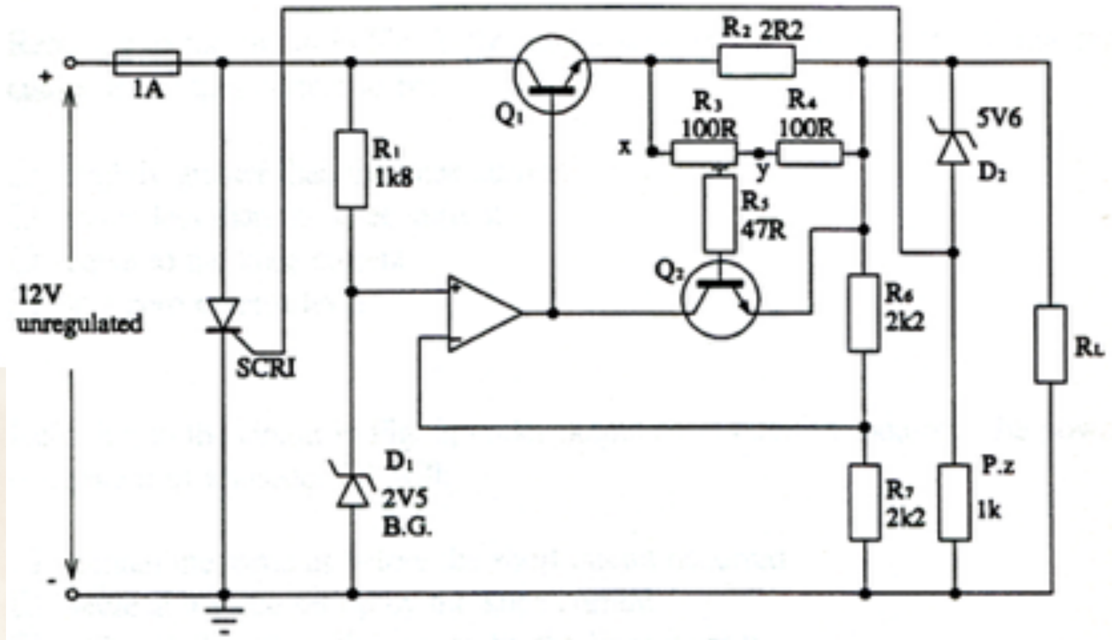


Fig 3.11

16. Refer to Figure 3.11. If R2 = 4k7 R3 = 1k and the zener diode is 3.9 V, the output voltage will be approximately:
(a) 7.83 V
(b) 25.65 V
(c) 15.5 V
(d) 18.8 V



The next questions refer to the circuit shown above.

17. The circuit shown uses the _________ method of current limiting:
(a) foldback method
(b) constant current method
(c) constant resistance method.
(d) constant voltage method.

18. In the circuit shown, resistor R2 is needed to:
(a) sense the output load current
(b) limit the the base collector current of transistor Q2.
(c) switch transistor Q2 at a faster rate
(d) Limit the collector current of Q2

19. Referring to the circuit shown above, the output short circuit characteristic of this regulator causes the output current to be:
(a) slightly greater than the knee current
(b) much less than the knee current
(c) equal to the knee current
(d) at a zero current level.

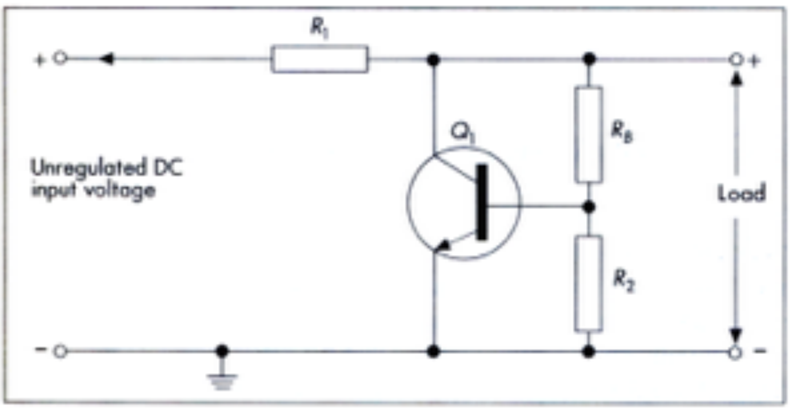
20. Referring to the circuit shown above, under output short circuit conditions, the power dissipation of transistor QI will:
(a) remain the same as before the short circuit occurred
(b) settle at a value set up by the knee current
(c) reduce below the value set up by the knee current
(d) reduce to zero because it will be cutoff

1. Briefly explain why voltage regulation is required in a circuit.

2. An 18 V zener diode requires 15 mA to hold breakdown, and a circuit current of 85 mA ±5 mA is required. If the input voltage is 25 V, calculate the value of series resistor required.

3. What is the minimum power rating of the zener diode used in question 2?

4. Why are transistor shunt regulators like the one shown here only used in low current applications?



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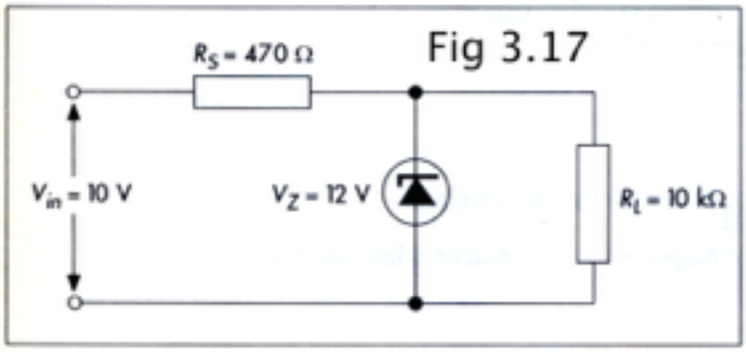
5. What is the output voltage of the circuit in Figure 3.17?

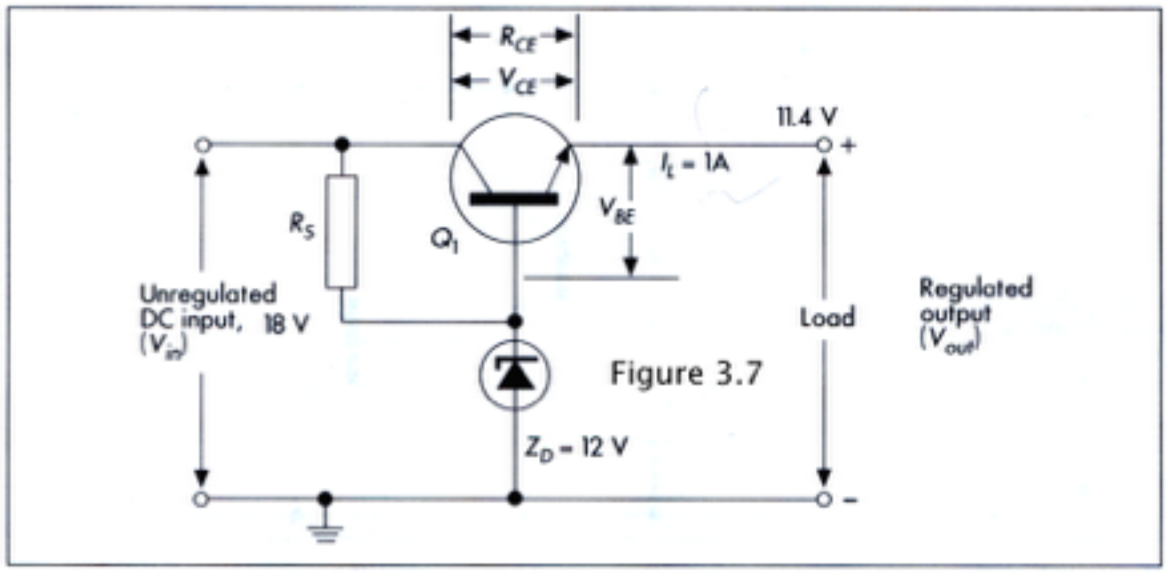


6. A series transistor regulator circuit (such as the one in Figure 3.7) has an input voltage of 15 V. The zener diode voltage is 12.5 V, and the zener current is 100 mA. If the load current is 1 A, calculate: (Q1 beta about 50)

(a) the circuit efficiency;

(b) the zener power rating; and

(c) the power dissipated by the transistor.



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7. Briefly explain the circuit operation of a series transistor regulator as shown in figure 3.11when:

(a) the load resistance decreases; or
(b) the input voltage increases.

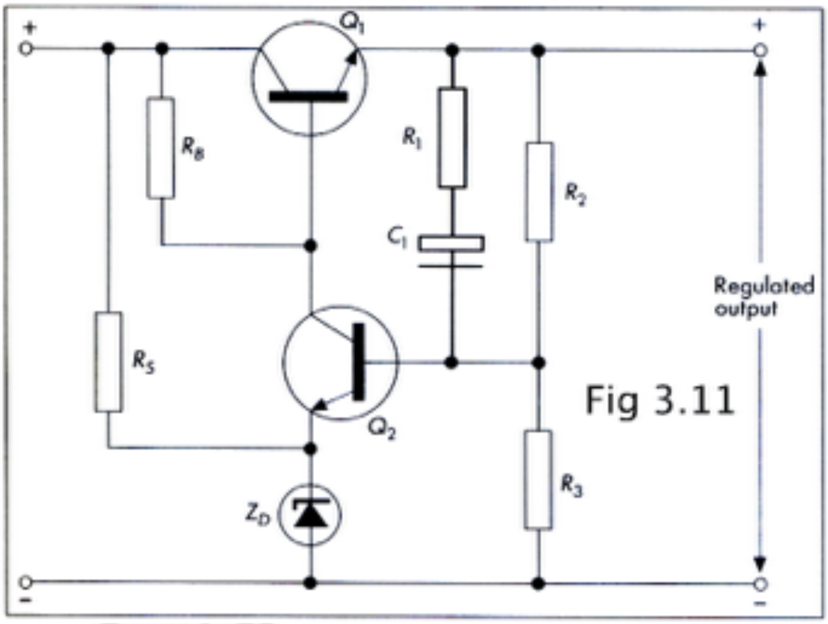


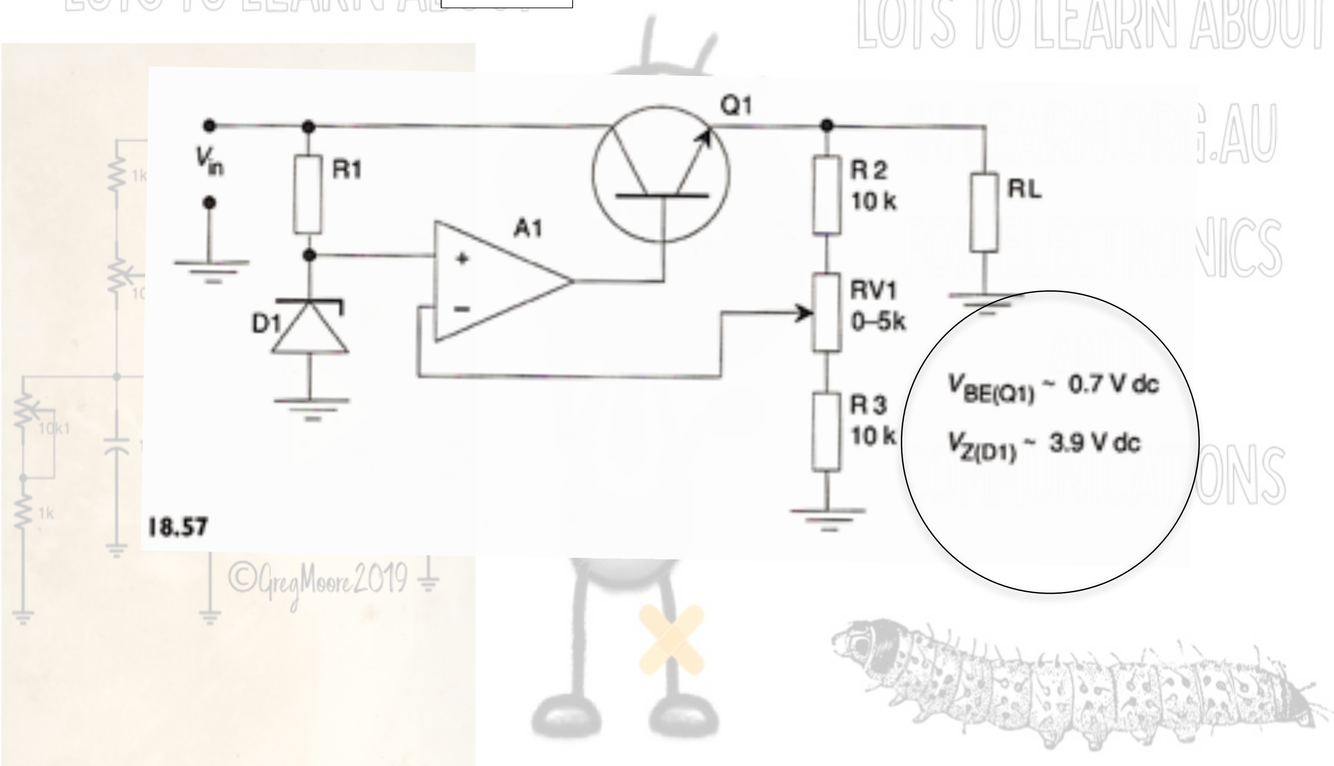
Fig 3.11

8. How can a series regulator be protected against overload currents?

9. What is the difference between an 'open-loop' and a 'closed-loop' regulator circuit?

10. What is the purpose of a constant current regulator? If the current changed from 1.5 A under no load to 1.2 A under full load, what would the percentage regulation be? Is this percentage satisfactory?

11 . Study the circuit of a BJT series pass Voltage regulator employing an operational amplifier. in the error correction circuit Show the range of output values which the PSU if capable of operating at. Unregulated input is 20Vdc.

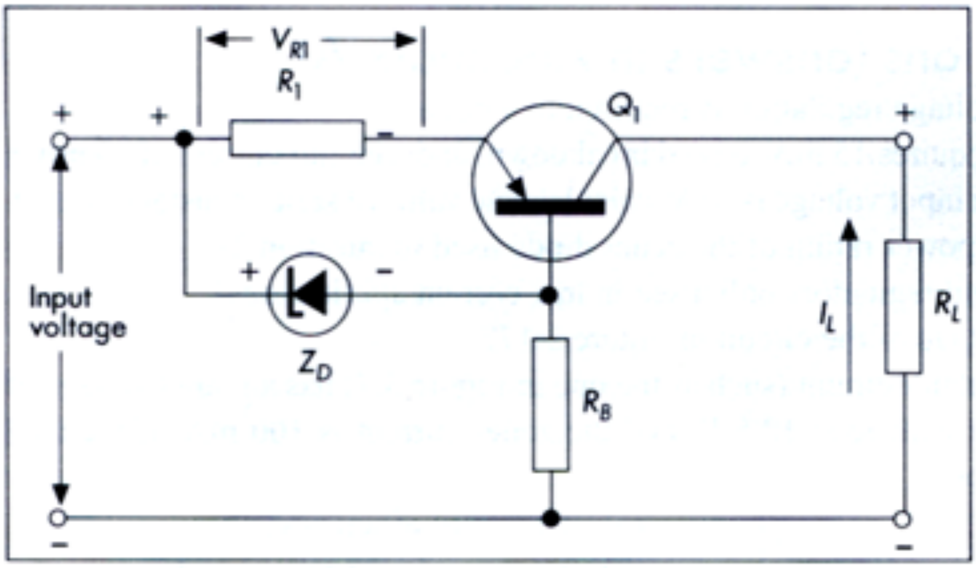


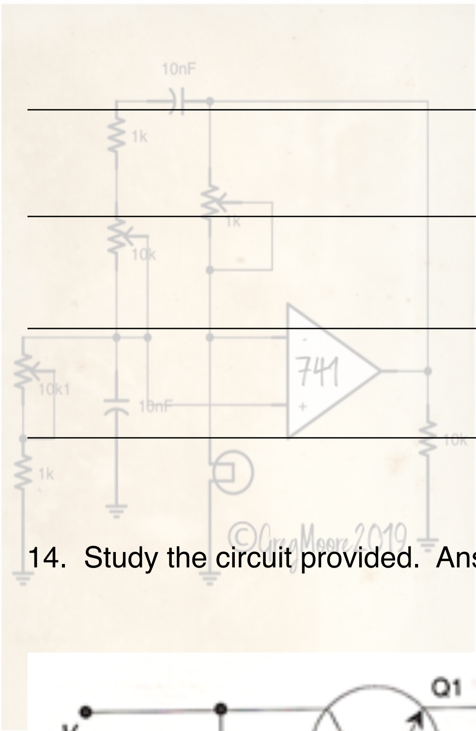
12. Include in the circuit shown in question 11, the circuit of a crowbar protection system for a series pass PSU. Explain how it works. circle your protection components to make them easy to identify for somebody working on the power supply.

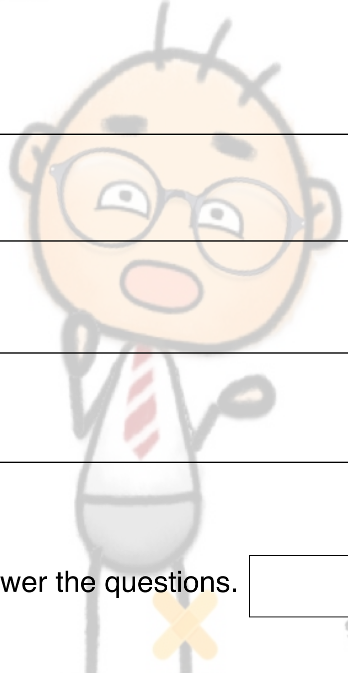
13.
The circuit shown here is what type of regulator?

In your own words, explain how this regulator works.

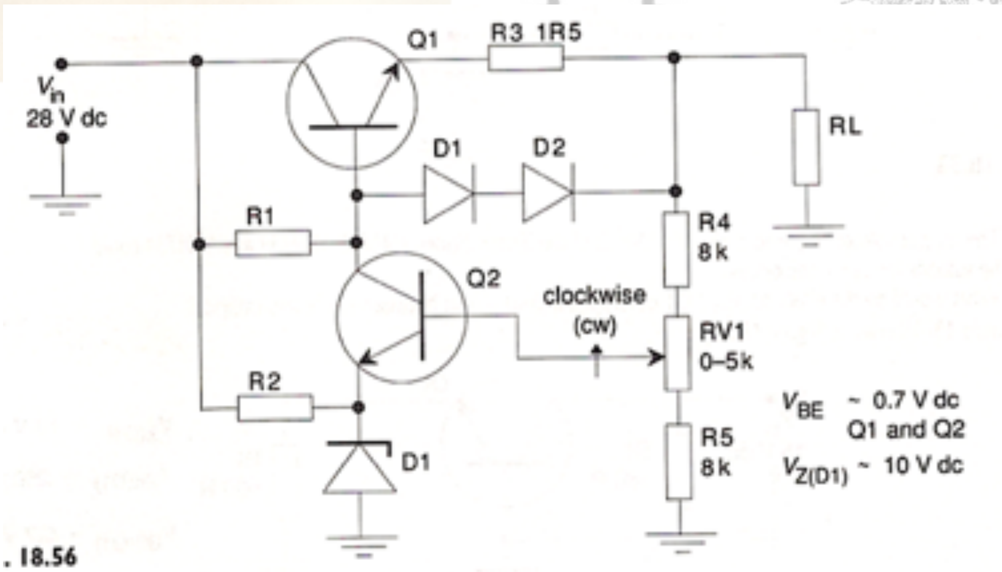
If the load increases or decreases, how is regulation maintained?







14. Study the circuit provided. Answer the questions.



. 18.56

1. Calculate VL max

2. Calculate VL min

3. Calculate VL when RV1 is half way.

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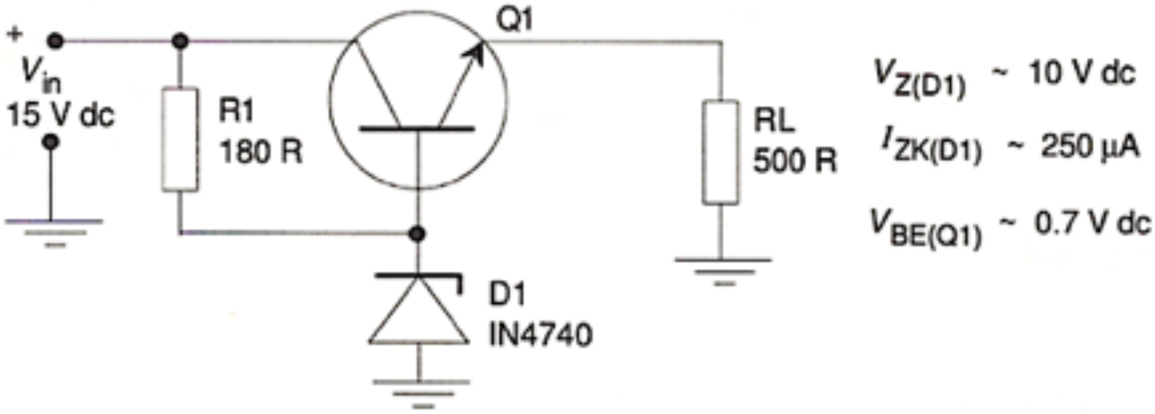
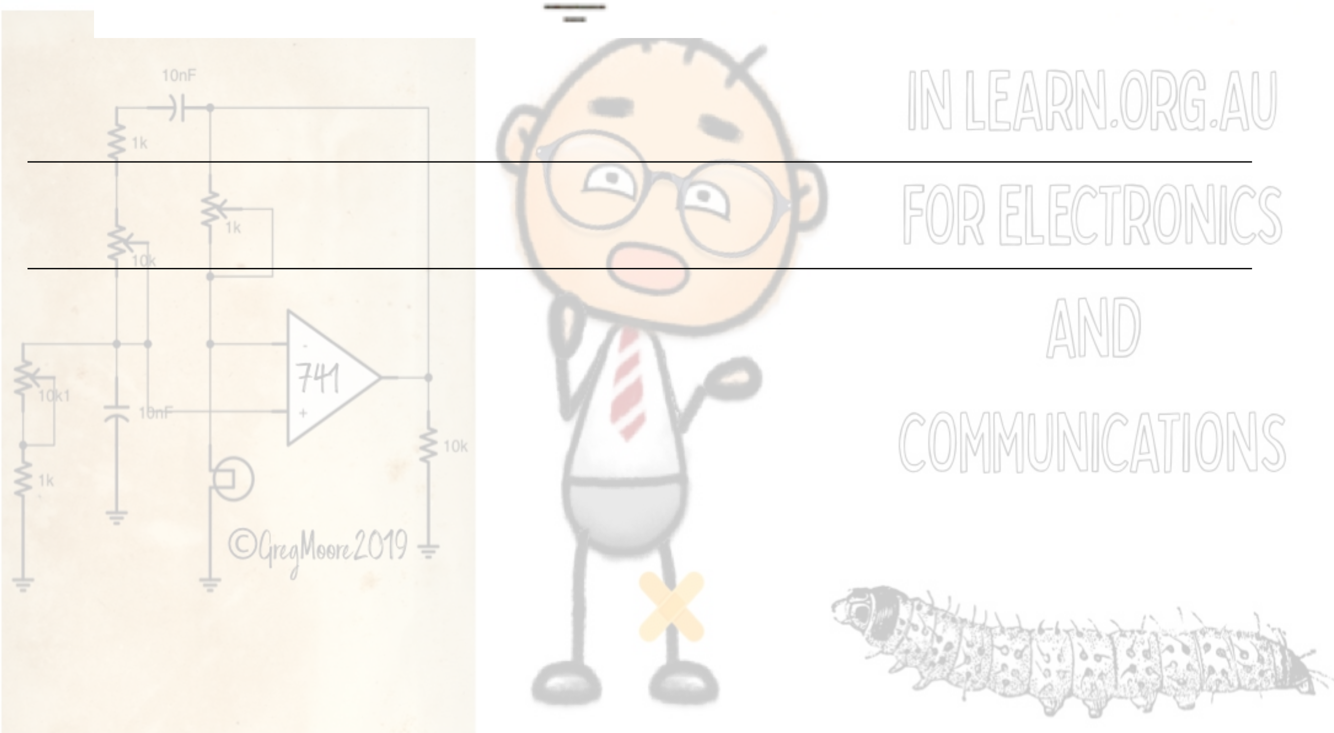
15. What effect would D1 developing a short circuit between Cathode and Anode?





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