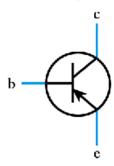
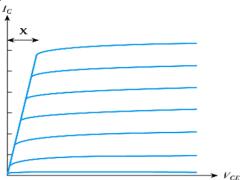
Problem set 4 TFY4185 Måleteknikk Issued 12 October 2015

- 1) Which terminal represents the control input of a bipolar transistor?
 - a) The gate
 - b) The collector
 - c) The base
 - d) The emitter
- 2) What kind of device does the following symbol represent?

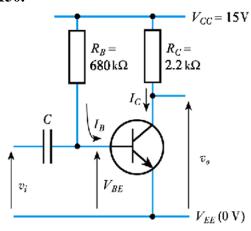


- a) An *npn* bipolar transistor.
- b) An *n*-channel JFET.
- c) A pnp bipolar transistor.
- d) A p-channel JFET.
- 3) Which of the following expressions represents the DC current gain of a bipolar transistor?
 - a) dI_C/dI_B
 - b) I_{C}/I_{B}
 - c) $\mathrm{d}I_\mathrm{C}/\mathrm{d}V_\mathrm{BE}$
 - d) $I_{\rm C}/V_{\rm BE}$
- 4) Which of the following expressions represents the transconductance of a bipolar transistor?
 - a) $I_{\rm C}/V_{\rm BE}$
 - b) dI_C/dV_{BE}
 - c) $I_{\rm C}/I_{\rm B}$
 - d) dI_C/dI_B

5) In the bipolar transistor output characteristics shown below, what region is represented by the symbol 'X'?

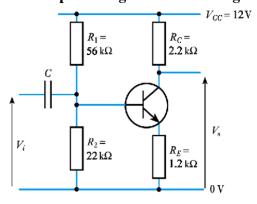


- a) The active region
- b) The space-charge region
- c) The saturation region
- d) The ohmic region
- 6) Determine the quiescent collector current of the following circuit, given that the $h_{\mbox{FE}}$ of the transistor is 150.



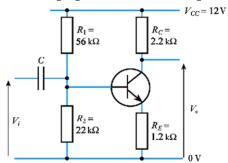
- a) 1.15 mA
- b) 2.1 mA
- c) 3.15 mA
- d) 5.3 mA

7) Determine the quiescent output voltage of the following circuit.



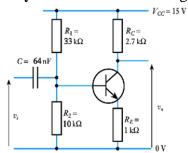
- a) 4.3 V
- b) 4.8 V
- c) 5.6 V
- d) 7.1 V

8) What is the small-signal voltage gain of the circuit given in the last question?



- a) -1.83
- b) -2.2
- c) 2.56
- d) -2.83

9) Determine the low-frequency cut-off of the following circuit.



- a) 75 Hz
- b) 250 Hz
- c) 324 Hz
- d) 2036 Hz

10) The noise power p	produced by a resisto	or is not dependent on	its resistance.	
a) True		b) False		
11) What form of noise is produced as a result of the random, thermally induced motion of the atoms in a material?				
a) Johnson noise	b) Shot noise	c) Flicker noise	d) Interference	
12) What form of nois charge carriers wi	_	esult of random variat	tions in the diffusion of	
a) Johnson noise	b) Shot noise	c) Flicker noise	d) Interference	
b) The noise has a to c) Most of the noise d) The noise has a to	e power is concentrate frequency equal to the power is concentrate uniform spectrum.	ed at high frequencies.	e dominated by thermal	
a) True		b) False		
15) Shot noise is norm	nally insignificant in	all forms of FET.		
a) True		b) False		
	oint in a circuit, a sig S/N ratio at this poi	•	rupted by 1 mV r.m.s. of	
a) 30 dB	b) 40 dB	c) 50 dB	d) 60 dB	

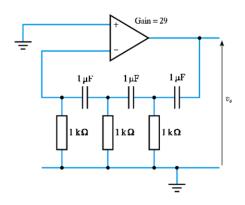
17) Combinations of conductors and components that form loops within a circuit act as electric dipoles.

a) True

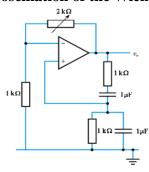
- 18) Which of the following is not an appropriate design method for tackling EMC related problems?
 - a) Routing noise sensitive signals around the outside of a printed circuit board to keep them away from other signals.

b) False

- b) Minimise the area of any loops formed.
- c) Use multilayer boards to reduce coupling between circuits.
- d) Minimise track lengths.
- 19) Calculate the frequency of oscillation of the phase-shift oscillator shown here.

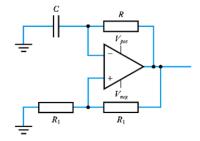


- a) 26 Hz.
- b) 65 Hz.
- c) 135 Hz.
- d) 238 Hz.
- 20) Calculate the frequency of oscillation of the Wien-bridge oscillator shown here.



- a) 159 Hz.
- b) 238 Hz.
- c) 327 Hz.
- d) 424 Hz.

21) What is the maximum positive output voltage of the relaxation oscillator shown here?



- a) V_{pos}
- b) $V_{pos}/2$
- c) $V_{pos}/4$
- d) $(C/R)V_{pos}$

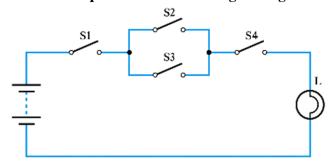
- 22) Crystals have two resonant frequencies.
 - a) True

- b) False
- 23) What elements are found within the equivalent circuit of a crystal?
 - a) Resistance alone.
- b) Resistance and capacitance.
- c) Resistance and inductance.
- d) Resistance, capacitance and inductance.
- 24) In order to ensure stability in a circuit, the designer must ensure that the phase shift reaches 180 degrees before the gain falls to unity.
 - a) True

- b) False
- 25) What is the name given to the amount (in dB) by which the loop gain is less than 0 dB when the phase reaches 180 degrees?
 - a) The gain margin.

- b) The transition point.
- c) The zero-gain bandwidth.
- d) The phase margin.

26) What logic function corresponds to the following arrangement?



- a) L = S1 AND (S2 OR S3) AND S4.
- b) L = S1 OR (S2 AND S3) OR S4.
- c) L = (S1 OR S2) AND (S3 OR S4).
- d) L = (S1 AND S2) OR (S3 AND S4).

27) Which logic gate has the following truth table?

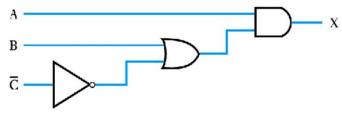
A	В	C
0	0	0
0	1	1
1	0	1
1	1	1

- a) A two-input AND gate.
- b) An exclusive OR gate.
- c) An exclusive NOR gate.
- d) A two-input OR gate.

28) In Boolean algebra the AND function is represented by the '+' sign.

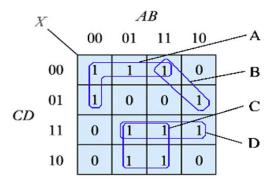
- a) True
- b) False

29) What Boolean expression describes the output X of this arrangement?



- a) X = A + B + C
- b) $X = A \cdot (B + C)$
- c) $X = (A \cdot B) + C$
- d) $X = A + (B \cdot C)$

30) In the Karnaugh map shown below, which of the loops shown represents a legal grouping?



A) B) C) D)