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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2014/2015**

COURSE NAME : ELECTRONICS  
COURSE CODE : DAE 21303  
PROGRAMME : 2 DAE  
EXAMINATION DATE : DECEMBER 2014 / JANUARY 2015  
DURATION : 2 HOURS 30 MINUTES  
INSTRUCTION : PART A  
ANSWER **ALL** QUESTIONS  
  
PART B  
ANSWER **THREE (3)** QUESTIONS  
ONLY

THIS QUESTION PAPER CONSISTS OF **SIXTEEN (16)** PAGES

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**PART A (40 marks)**

1. Valence electrons are
  - A. in the closest orbit to the nucleus
  - B. in the most distant orbit from the nucleus
  - C. in various orbits around the nucleus
  - D. not associated with a particular atom
  
2. How many valence electrons are there in a germanium semiconductor?
  - A. 1
  - B. 2
  - C. 4
  - D. None
  
3. The current in a semiconductor is produced by
  - A. electrons only
  - B. holes only
  - C. negative ions
  - D. both electrons and holes
  
4. A pure semiconductor is also referred to as
  - A. a clean room device.
  - B. intrinsic.
  - C. extrinsic.
  - D. transistor.
  
5. The V-I curve for a diode shows
  - A. the voltage across the diode for a given current
  - B. the amount of current for a given bias voltage
  - C. the power dissipation
  - D. none of these
  
6. Ideally, a diode can be represented by a
  - A. voltage source
  - B. resistance
  - C. switch
  - D. all of these

7. Silicon that has been doped with a pentavalent impurity is called
  - A. a p-type semiconductor.
  - B. an n-type semiconductor.
  - C. a conductor.
  - D. an insulator.
  
8. In an n-type semiconductor, the free electrons are called the
  - A. minority carriers.
  - B. majority carriers.
  - C. holes.
  - D. ions.
  
9. A silicon diode will allow a continuous current in the forward direction, if the source voltage is
  - A. greater than 0.7 V.
  - B. equal to 7.7 V.
  - C. less than 0.7 V.
  - D. zero.
  
10. When a 60 Hz sinusoidal voltage is applied to the input of a full-wave rectifier, the output frequency is
  - A. 120 Hz
  - B. 60 Hz
  - C. 240 Hz
  - D. 0 Hz
  
11. A circuit that removes all the positive parts of the input signal is a
  - A. positive clipper.
  - B. positive clamper.
  - C. negative clipper.
  - D. positive voltage doubler.
  
12. A clamper circuit adds
  - A. ac to the signal.
  - B. dc to the signal.
  - C. resistance to the load.
  - D. capacitance to the filter.

13. The basic idea of voltage regulation is that the output voltage remains the same
- A. with virtually no change of input voltage.
  - B. with considerable changes of input voltage.
  - C. when power is turned off.
  - D. even if a passive filter is used.
14. Ideally, a DC load line is a straight line drawn on the collector characteristic curves between
- A. the Q-point and cut-off
  - B. the Q-point and saturation
  - C.  $V_{CE(\text{cut-off})}$  and  $I_{C(\text{sat})}$
  - D.  $I_B = 0$  and  $I_B = I_C/\beta_{DC}$
15. A transistor's current gain is equal to
- A. collector current divided by emitter current.
  - B. emitter current divided by base current.
  - C. collector current divided by base current.
  - D. base current divided by collector current.
16. The saturation point determines the maximum
- A. power that can be dissipated.
  - B. supply voltage that can be used.
  - C. collector current for the circuit.
  - D. resistor that can be used in the collector circuit.
17. With amplifying circuits, the Q point must
- A. be in the cutoff region.
  - B. be in the saturation region.
  - C. remain in the active region.
  - D. not be on the load line.
18. Voltage-divider bias produces a fixed value of emitter current that results in a stable operating point that is
- A. always located at cutoff.
  - B. always located at saturation.
  - C. dependent on the current gain.
  - D. independent of the current gain.

19. What device is used to connect an ac signal into an amplifier without disturbing its operating point?
- A. bypass capacitor
  - B. filter capacitor
  - C. coupling capacitor
  - D. resistor
20. In order for a bypass capacitor to work properly, its reactance must be
- A. much smaller than the resistance.
  - B. much larger than the resistance.
  - C. equal to the resistance.
  - D. infinite.
21. The ac collector current divided by the ac base current is referred to as
- A. dc current gain.
  - B. ac current gain.
  - C. alpha.
  - D. delta.
22. What is a multistage amplifier?
- A. a single stage amplifier
  - B. a single stage attenuator
  - C. two or more attenuators cascaded
  - D. two or more amplifiers cascaded
23. If two or more amplifiers are connected to form a multistage amplifier
- A. gain remains constant.
  - B. gain increases.
  - C. gain is reduced.
  - D. more attenuation results.
24. How is the total voltage gain of a multistage amplifier calculated?
- A. sum of individual gains
  - B. difference of individual gains
  - C. product of individual gains
  - D. it is the gain of one amplifier

25. Which of the following classes of amplifier operation has the highest power efficiency?
- A. Class A.
  - B. Class B.
  - C. Class C.
  - D. Class AB
26. An amplifier's voltage gain can be stabilized by
- A. increasing  $R_L$ .
  - B. decreasing  $R_L$ .
  - C. leaving some of the emitter resistance unbypassed.
  - D. reducing the power supply voltage.
27. The power rating of a transistor can be effectively increased
- A. by using bigger transistors.
  - B. by reducing power supply voltages.
  - C. by using heat sinks.
  - D. by using slow-blow fuses.
28. When a transistor circuit operates as a class B amplifier
- A. the output is an exact reproduction of the input.
  - B. one half cycle is clipped off.
  - C. there is no distortion.
  - D. most of the cycle is clipped off.
29. Since the field-effect transistor depends on only one type of charge, it is referred to as \_\_\_\_\_.
- A. unipolar
  - B. bipolar
  - C. singular
  - D. unilateral
30. With a JFET, the gate-source diode is
- A. always reverse-biased.
  - B. always forward-biased.
  - C. is connected to the drain voltage.
  - D. is connected to ground.

31. The channel of a JFET is between
- A. gate and drain
  - B. drain and source
  - C. gate and source
  - D. input and output
32. The current flowing from the JFET's source to drain must pass through what between the depletion layers?
- A. gate
  - B. ground
  - C. channel
  - D. base
33. The JFET is a
- A. voltage-controlled device.
  - B. current-controlled device.
  - C. bipolar device.
  - D. nonlinear device.
34. Which JFET amplifier configuration exhibits a very high input impedance and low output impedance?
- A. common-source
  - B. common-gate
  - C. source follower
  - D. drain follower
35. Which is not a mode of operation for the 555 timer?
- A. astable
  - B. free running
  - C. bi-stable
  - D. monostable
36. When the 555 timer is used with only one stable state, it is referred to as
- A. a monostable multivibrator.
  - B. an astable multivibrator.
  - C. a free running multivibrator.
  - D. a bi-stable multivibrator.

37. When the 555 timer is operated with no stable states, it is called
- A. a monostable multivibrator.
  - B. an astable multivibrator.
  - C. a bi-stable multivibrator.
  - D. a flip-flop.
38. The monostable 555 timer circuit produces a single pulse whose width is determined by
- A. the external resistor and capacitor used.
  - B. the trigger.
  - C. the value of the supply voltage.
  - D. the internal capacitance.
39. The oscillation frequency of an astable multivibrator is determined by
- A. a diode and resistor.
  - B. a crystal.
  - C. two external resistors and one capacitor.
  - D. two external capacitors and one resistor.
40. Colpitts, Clapp, and Hartley are names that refer to
- A. types of RC oscillators
  - B. inventors of the transistor
  - C. types of LC oscillators
  - D. types of filters



**PART B** (60 marks)

**Q1** (a) Determine the diode current  $I_D$  and the diode voltage  $V_D$  for the diode circuits of **Figure Q1(a)(i)** and **Figure Q1(a)(ii)**, assuming that the diode is silicon.

(6 marks)

(b) **Figure Q1(b)** shows a DC power supply circuit using a capacitor filter.

(i) Calculate the peak output load voltage and the output ripple voltage if the DC load current is 0.1 A.

(ii) If the filter capacitor is opened, draw the output voltage waveform and find its dc value.

Assume that the diode forward voltage drop is 0.7V.

(8 marks)

(c) **Figure Q1(c)** shows a circuit combining a positive limiter with a negative limiter. Determine the output voltage waveform.

(6 marks)

**Q2** Based upon the circuit configuration in **Figure Q2**, determine the following values. Assume  $\beta = 180$ .

(a) Base current,  $I_B$  (4 marks)

(b) Collector current,  $I_C$  (1 mark)

(c) Base voltage,  $V_B$  (2 marks)

(d) Collector voltage,  $V_C$  (2 marks)

(e) Collector- Emitter Q point voltage,  $V_{CEQ}$  (3 marks)

(f) Base-Collector voltage,  $V_{BC}$  (1 mark)

(g) Saturation current,  $I_{C(sat)}$  (1 mark)

(h) Cut-Off value of Collector- Emitter voltage,  $V_{CE(cut-off)}$  (1 mark)

(i) Draw the DC load line (3 marks)

(j) On the load line, plot the Q point of the given circuit (2 marks)

**Q3** Figure Q3 shows the circuit of a two stage RC coupled amplifier :

- (a) Determine the operating point of transistor Q1 and Q2. ( $I_{BQ}$ ,  $I_{CQ}$ ,  $V_{CEQ}$ ) (5 marks)
- (b) Draw and label the ac equivalent circuit (2 marks)
- (c) Determine the ac emitter resistance,  $r'_e$  for Q1 and Q2. (3 marks)
- (d) Calculate the input impedance of the first stage,  $Z_{in(1)}$ . (3 marks)
- (e) Determine the voltage gain for each stage and overall gain. (4 marks)
- (f) What is the output voltage,  $v_o$  if the input signal,  $v_i$ , is  $20 \text{ mV}_{pp}$ . (3 marks)

**Q4** For the common source JFET amplifier as shown in Figure Q4,

- (a) solve for the following dc quantities :
  - (i) gate voltage,  $V_G$
  - (ii) drain current,  $I_D$  if  $V_{GS} = -1 \text{ V}$
  - (iii) drain voltage,  $V_D$
  - (iv) drain saturation current,  $I_{D(SAT)}$
  - (v) cutoff voltage,  $V_{DS(CUTOFF)}$

(10 marks)
- (b) solve for the following ac quantities
  - (i) ac drain resistance,  $r_D$
  - (ii) ac source resistance,  $r_s$
  - (iii) draw the ac equivalent circuit
  - (iv) the voltage gain given  $g_m = 2500 \mu\text{S}$
  - (v) ~~(vi)~~ the output voltage

(10 marks)

**Q5** (a) For the Colpitts oscillator circuit as shown in **Figure Q5(a)**, calculate the following:

- (i) frequency of oscillator
- (ii) value of feedback fraction,  $B$
- (iii) minimum value of voltage gain,  $A_v$ , for the oscillator to start.

(10 marks)

(b) For the 555 timer circuit as shown in **Figure Q5(b)**,

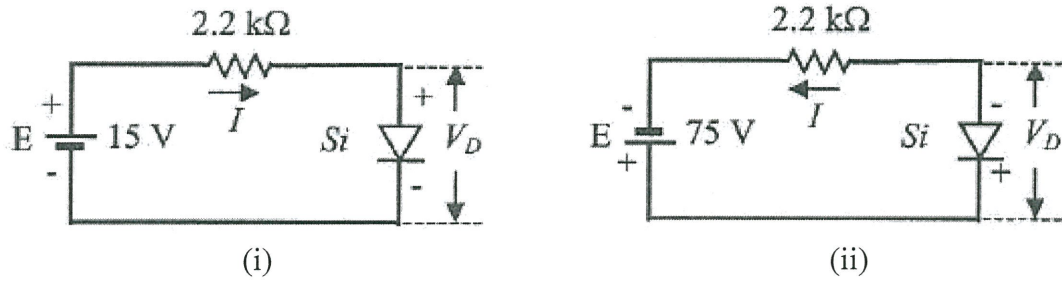
- (i) calculate the frequency of the output signal.
- (ii) what is the duty cycle
- (iii) draw the output waveform

(10 marks)

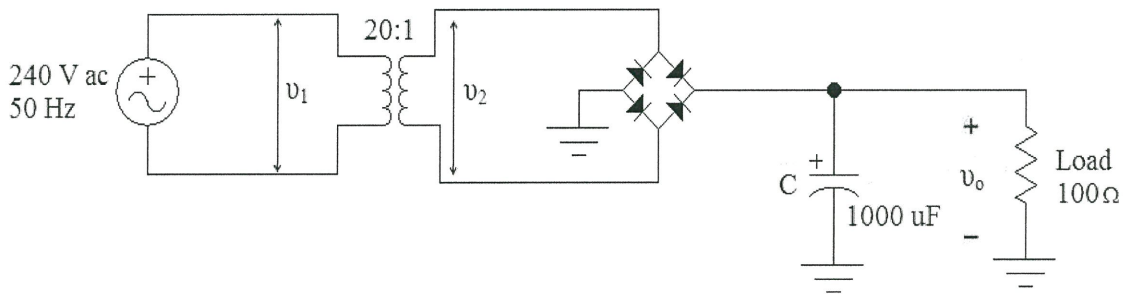
**FINAL EXAMINATION**

SEMESTER/SESSION : SEM I/2014/2015  
 COURSE NAME : ELECTRONICS

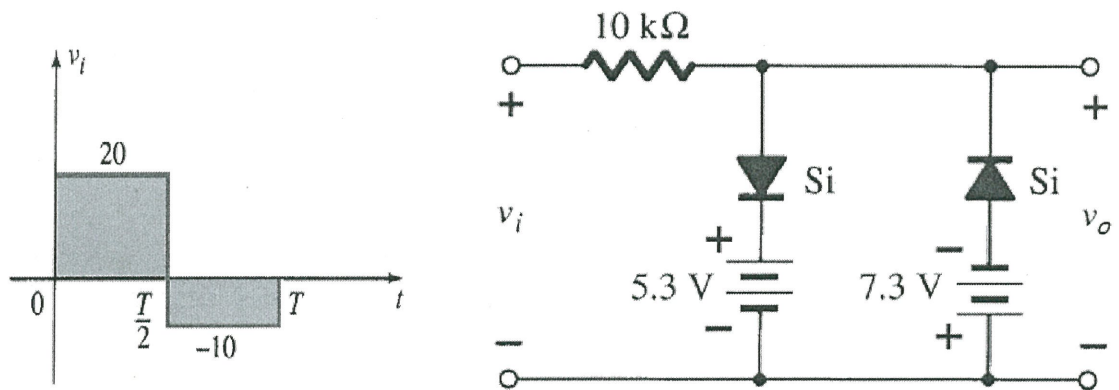
PROGRAMME : 2 DAE  
 COURSE CODE : DAE 21303



**FIGURE Q1(a)**



**FIGURE Q1(b)**

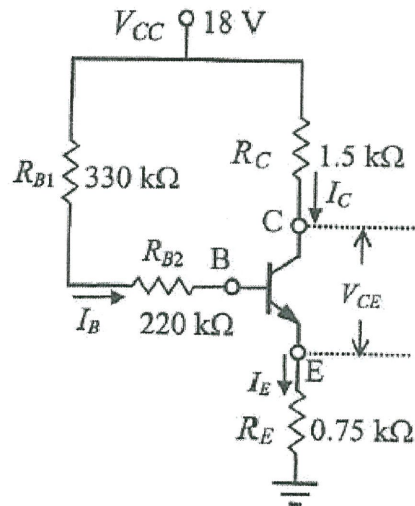


**FIGURE Q1(c)**

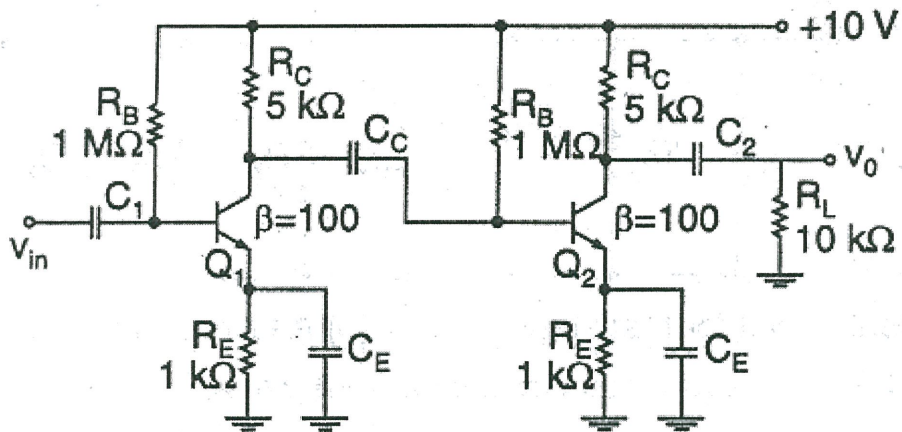
**FINAL EXAMINATION**

SEMESTER/SESSION : SEM I/2014/2015  
 COURSE NAME : ELECTRONICS

PROGRAMME : 2 DAE  
 COURSE CODE : DAE 21303



**FIGURE Q2**

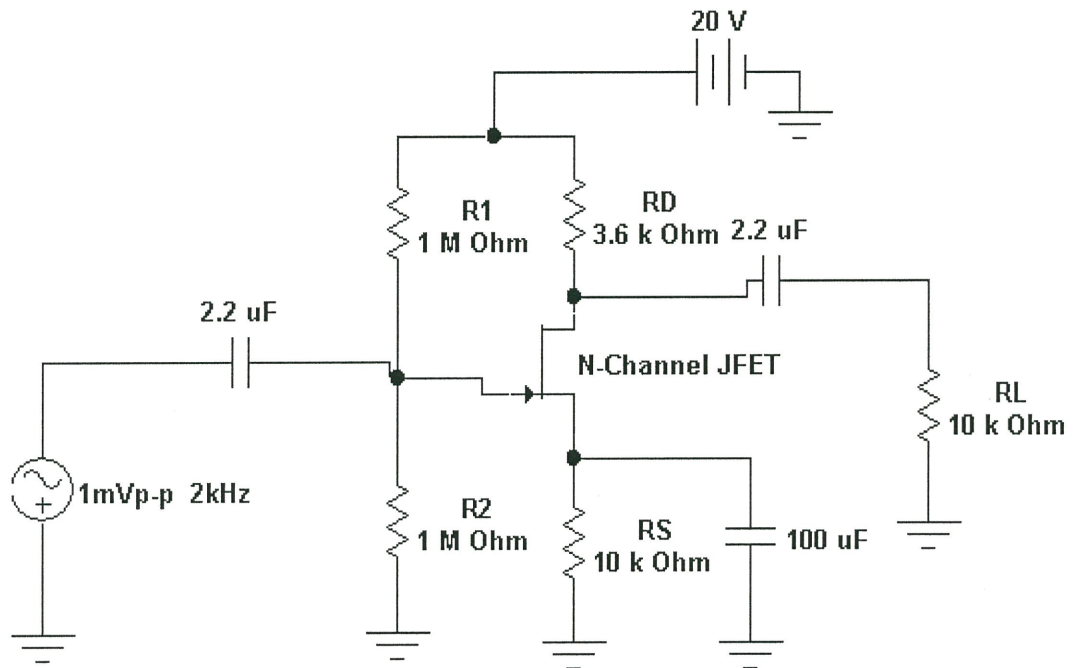


**FIGURE Q3**

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SEMESTER/SESSION : SEM I/2014/2015  
 COURSE NAME : ELECTRONICS

PROGRAMME : 2 DAE  
 COURSE CODE : DAE 21303

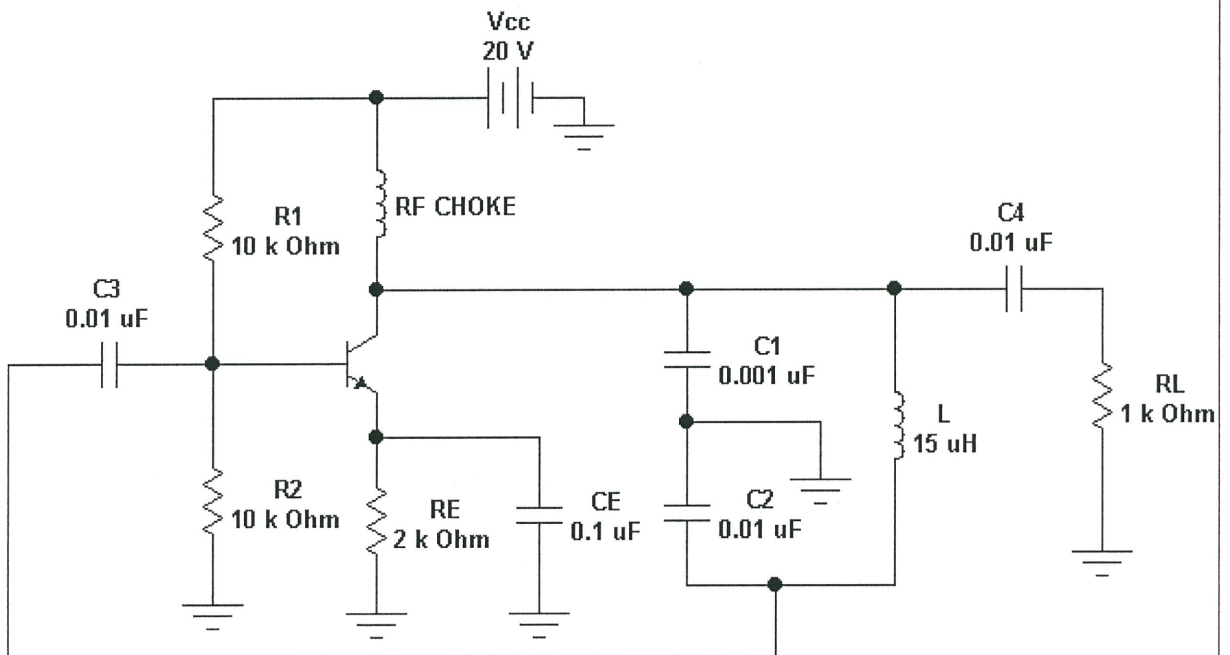


**FIGURE Q4**

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SEMESTER/SESSION : SEM I/2014/2015  
COURSE NAME : ELECTRONICS

PROGRAMME : 2 DAE  
COURSE CODE : DAE 21303

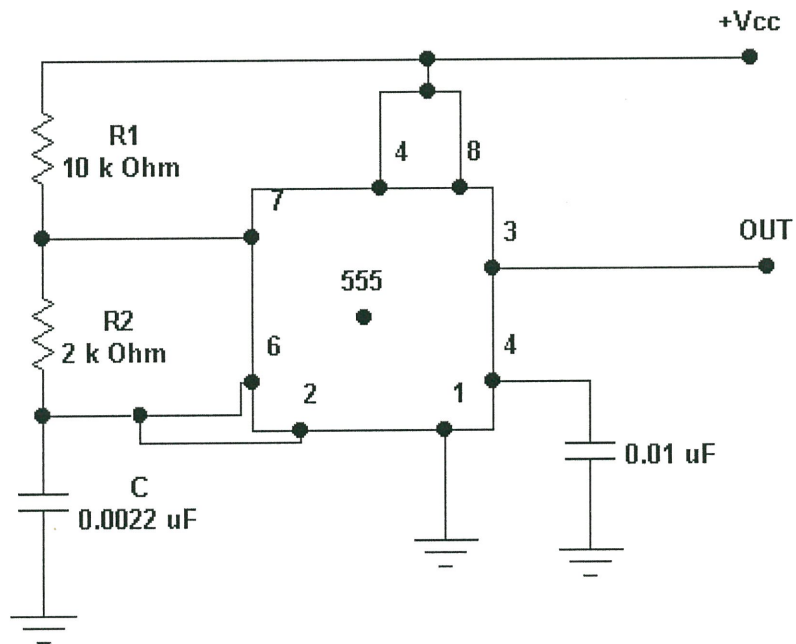


**FIGURE Q5(a)**

**FINAL EXAMINATION**

SEMESTER/SESSION : SEM I/2014/2015  
COURSE NAME : ELECTRONICS

PROGRAMME : 2 DAE  
COURSE CODE : DAE 21303



**FIGURE Q5(b)**