UNIVERSITY OF JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING : ELECTRICAL*
SUBJECT	:	**RADIO ENGINEERING III**
CODE	:	**EER3111**
DATE	:	SUMMER EXAMINATION 2015 10 NOVEMBER 2015
DURATION	:	(SESSION 1) 08:30 - 11:30
WEIGHT	:	40 : 60
TOTAL MARKS	:	111

EXAMINER	:	MR N.E MABUNDA
MODERATOR	:	J SEBASTIAN 2050
NUMBER OF PAGES	:	5 PAGES

INSTRUCTIONS	:	ONE NON-PROGRAMMABLE CALCULATOR PER STUDENT PERMITTED.

QUESTION 1

1.1 Sketch on the same set of axes, curves that are labelled with realistic values, to illustrate the differences in bandwidth and selectivity of a tuned circuit; given by Q of 50, 100 and 200. . The center frequency is 1 GHz, and shape factor of 2.

1.2 A super heterodyne receiver must cover the range from 220 to 224 MHz the First IF is 10.7 MHz; the second is 1.5 MHz (Assume a local oscillator frequency higher than the input by the IF.) Find :

1.2.1 the local oscillator tuning range,
1.2.2 the frequency of the second local oscillator,
1.2.3 and the first IF image frequency range. (6)

[16]

QUESTION 2

2.1 With the aid of neat labeled graphs, circuit diagrams and short explanation illustrate how broadband amplifiers can be compensated for both upper and lower cut off frequencies. (10)

2.2 Explain with the aid of circuit diagrams how neutralizing can be achieved by using the Hezeletine method. (4)

[14]

QUESTION 3

An A.M radio receiver uses identical ganged capacitors in its aerial and local oscillator circuits, with an additional 82 pF padder capacitor in the oscillator circuit. When the receiver is tuned between 540 kHz and 1200 kHz the antenna capacitance varies between 180 pF and 470 pF. IF is correct at 450 kHz when the receiver is tuned to 1200 kHz. Calculate the tracking error in kHz when the radio is tuned to 825 kHz. **[6]**

QUESTION 4

4.1 With the aid of a neat labeled block diagram, explain how 80 MHz FM signal is demodulated when using a phase lock loop circuit. (7)

4.2 List two other Radio frequency applications of phase lock loop circuits.

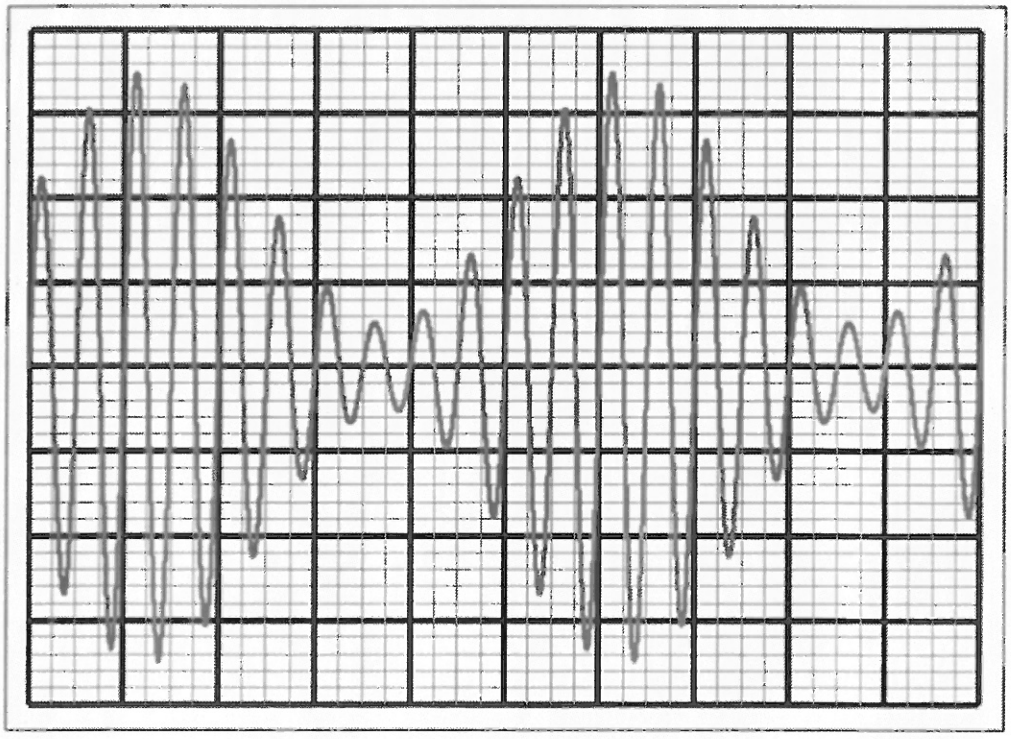
(2)
[9]

QUESTION 5

Sketch a neat labeled circuit of slope detector for an FM receiver, and explain how it operates. Include neat labeled graph to support your explanations.

[10]

QUESTION 6



The waveform above is displayed on an oscilloscope that is set to 2 V per division and 0.02 ms per division. Consider this, to determine:

4/...

QUESTION 6 CONTINUED

6.1	the frequency of the modulating signal,	(2)
6.2	the carrier frequency ,	(2)
6.3	the peak amplitude of the modulating signal,	(2)
6.4	the peak amplitude of the carrier signal,	(2)
6.5	the percentage of modulation,	(1)
6.6	and the total **side band** power dissipated by a 75Ω antenna which is connected to transmit this signal.	(3)

[12]

QUESTION 7

Sketch a circuit of high level collector modulator which is connected to a 24 V dc supply, explain with the aid of neatly labeled waveforms how a 10 kHz tone use this circuit to amplitude modulate a carrier of 100 kHz to a depth of 100 % .

[14]

QUESTION 8

What is the maximum bandwidth of an FM signal with a deviation of 5 MHz and a maximum modulating signal of 10 MHz? Draw a neat labeled frequency chart to illustrate your results.

[8]

QUESTION 9

With the aid of a neat circuit (s), waveforms and explanations; illustrate the operation of the lattice modulator. **[12]**

QUESTION 10

10.1 Derive an equation for the resulting antenna field strength obtained when a ½ dipole is radiating vertically polarized electromagnetic waves, and is **n** wavelength above a perfectly reflecting ground plane. (8)

10.2 With respect to antennas describe standing waves. (2)

[10]

TOTAL MARKS = 111