PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING : ELECTRICAL*
SUBJECT	:	**RADIO ENGINEERING III**
CODE	:	**EER3111**
DATE	:	SUMMER SUMPLEMENTARY
	:	2020
DURATION	:	3 HOURS
WEIGHT	:	40 : 60
TOTAL MARKS	:	100

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NUMBER OF PAGES	:	5 PAGES

INSTRUCTIONS	:	ONE NON-PROGRAMMABLE CALCULATOR PER STUDENT PERMITTED.

QUESTION 1

Use the specification for a primary tuned class A RF amplifier are given in Table 1 to answer the following questions.
above.

Lp = Ls	6.8µH
Rp = Rs	1 Ω
Cp	47 pF
Co	56 pF
Ro	82 kΩ
RL	1 kΩ
k	0
gm	6.8 mS

Table 1

1.1 Calculate the resonant frequency. (2)
1.2 Calculate the 3 dB bandwidth of the amplifier. (7)
1.3 Calculate the voltage gain of the amplifying stage. (2)
[11]

QUESTION 2

A dual conversion supeheterodyne receiver has the following specifications:

Signal frequency range 220 MHz – 225 MHz
Intermediate frequency 10.7 MHz and 1.89 MHz

2.1 Sketch the block diagram for this receiver. (4)
2.2.1 Calculate the 1st local oscillator tuning range. (2)
2.2.2 Calculate frequency of the second local oscillator. (2)
2.3 Explain the problem of "Image frequency" using one of the signal frequencies; explain how image frequency is prevented in this receiver. Calculate the actual frequencies as part of your answer. (4)
[12]

QUESTION 3

Discuss the 3 advantages of including RF amplifier on a radio receiver.
[6]

QUESTION 4

An antenna has an impedance of 39 Ω. A non-modulated AM signal produces a current of 5 A. The modulation is 100 percent. Calculate the following.

4.1	Carrier power,	(3)
4.2	Total power	(5)
4.3	Side-band power.	(2)
		[10]

QUESTION 5

Answer the following questions using figure 1.

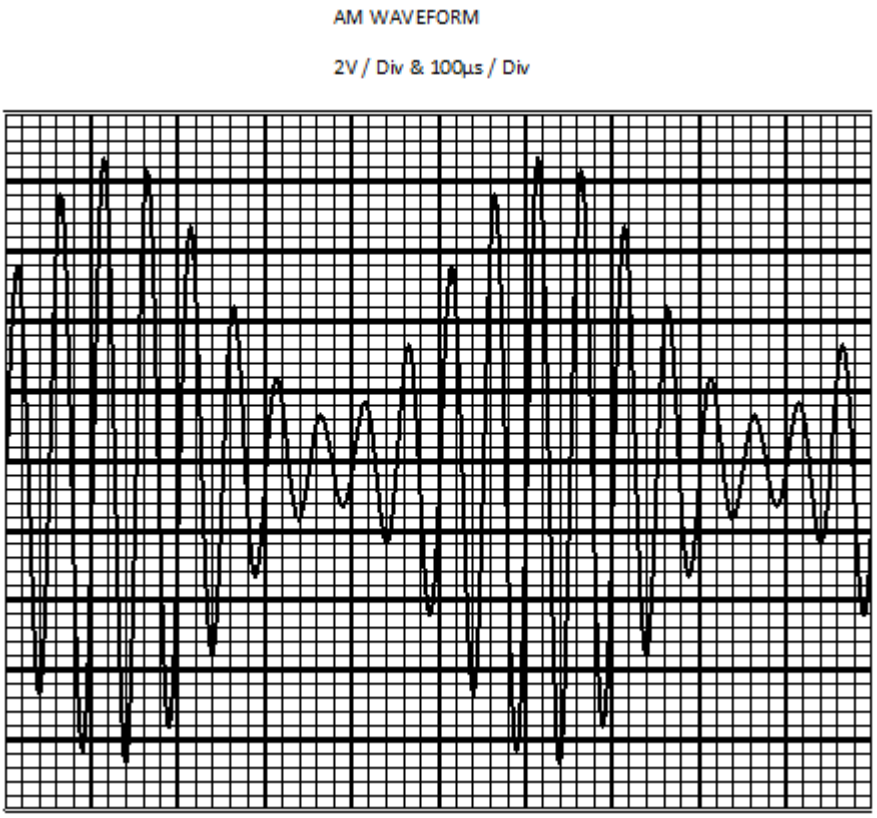

Figure 1

5.1	Derive an A.M equation for the wave.	(11)
5.2	Sketch the frequency spectrum chart for this A.M signal.	(4)
		[15]

QUESTION 6

6.1 Draw a block diagram of a single side band (SSB) transmitter which uses the phase cancellation technique to produce the Lower sideband (3)

6.2 Mathematically prove that the output contains only the Lower sideband (4)

[7]

QUESTION 7

Explain with the aid of block diagrams, graphs and mathematical analysis how frequency changing is accomplished in an additive mixer. Derive the expression for the output of the mixer and show that it contains the Intermediate Frequency (IF).

[10]

QUESTION 8

An RF amplifier has a first-stage load resistance of 22 kΩ, a coupling capacitance of 180 nF and an input resistance to the next stage of 22 kΩ.

8.1 Calculate the uncompensated lower cut-off frequency. (1)

8.2 Calculate the values of the additional components required to extend the lower cut-off frequency to 25 Hz. (2)

8.3 Sketch the compensated amplifier and explain the operating principle. (5)

[8]

QUESTION 9

Draw a labelled block diagram of phase-locked loop, which is locked to the output frequency of 100 kHz. Assume an output frequency to input frequency ratio of 5. Clearly label your blocks with calculated frequency values. **[6]**

QUESTION 10

Describe the term directivity as used for antennas, use polar diagram to illustrate high directivity and low directivity.

[8]

QUESTION 11

Give a summary of the most important features of the Yagi-Uda antenna.

[7]

Total: 100 Marks
