



Kafrelsheikh University - Faculty of Engineering			
Course	Communication systems	Date	21/3/2021
Time	3 Hours	Mark	85
Students	3 <sup>rd</sup> year Electronics and Electrical Communications		

This exam measures competences no.: A.1, A.2, B. 2, B.3, C.1.

**Answer all the following questions:**

Clarify your answer with the suitable diagrams.

- Q1.a Draw and Explain how the Ring Modulator Works. (5 Marks)
- Q1.b Draw the Envelop detector circuit and explain how to use it to demodulate a Conventional Amplitude Modulation signal. (10 Marks)
- Q2.a Explain How to generate a narrow-band angle modulated signal and how to use it to construct an angle modulated signal. (10 Marks)
- Q2.b Draw and Explain the superheterodyne receiver used in AM radio broadcast. (5 Marks)
- Q3.a Draw and Explain FM Stereo Broadcasting used in Radio communication. (10 Marks)
- Q3.b Prove that the bandwidth requirement for the DSB-SC is  $W=2f_m$ , where  $f_m$  is the maximum frequency of the message signal  $m(t)$ . Assume the spectrum of the modulating signal  $M(f)$ , then draw the DSB-SC signal  $U(f)$ . (10 Marks)
- Q4.a- An DSB-TC AM signal is generated by modulating the carrier  $f_c = 800$  kHz by the signal  $m(t) = \sin 2000\pi t + 5 \cos 4000\pi t$ . The AM signal is  $u(t) = 100[1+m(t)] \cos 2\pi f_c t$ . (10 Marks)
- a- Determine and sketch the spectrum of the AM signal.
- b- Determine the average power in the carrier and in the sidebands.
- Q4.b Explain Why the Full AM is used in Radio communication systems. (5 Marks)
- Q5.a. Explain How to construct Full AM Modulation using Power-Law Modulation. (10 Marks)
- Q5.b The output signal from an DSB-TC AM modulator is (10 Marks)
- $$u(t) = 5 \cos 1800\pi t + 20 \cos 2000\pi t + 5 \cos 2200\pi t$$
- a. Determine the modulating signal  $m(t)$  and the carrier  $c(t)$ .
- b. Determine the modulation index.
- c. Determine the ratio of the power in the sidebands to the power in the carrier.