This exam paper is for:

Test Student

A00123456

Each exam is equally difficult.
Answer your own exam.

Do not start until you are told to do so.

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MID-TERM EXAMINATION
9:30 – 11:20 AM
November 4, 2015

This exam has five (5) questions on two (2) pages. The marks for each question are as indicated. There are a total of 16 marks. Answer all questions. Write your answers and all rough work in the exam book provided. Show your work. Draw a box around your final answer. Numerical answers must include units. You may answer the questions in any order. Books and notes are allowed. No electronic devices other than calculators are allowed. Take this exam paper with you when you leave.

Show your work.

Question 1 (4 marks)

A system broadcasts traffic information for the streets of a city. There are four possible states for each street: no traffic (this is the case 50% of the time), light traffic (25% of the time), heavy traffic (4%) and stopped (1%).

(a) If we treat the traffic on a street as a message, what is the entropy of this source in bits per message?

(b) How many bits per second are required to transmits this information once per minute for 1000 streets. Assume the best possible compression technique is used.

Question 2 (3 marks)

The Cyrillic small letter 'ZHE' (ж) has the Unicode code point U+0436.

How many bytes are required to encode this character using UTF-8? What are the values of those bytes?
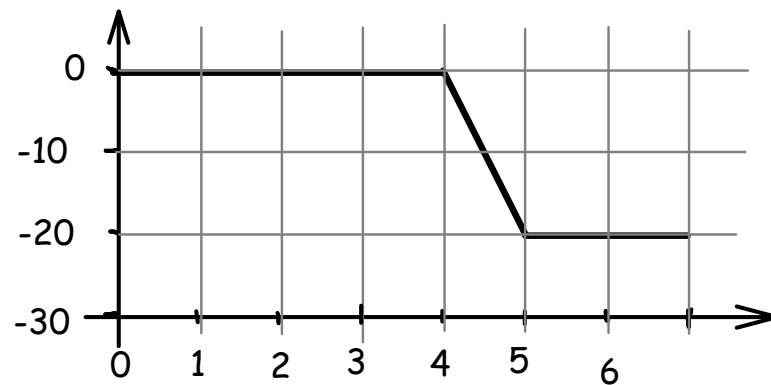
Question 3 (3 marks)

A 50 ohm coaxial cable uses a 24-gauge (AWG) inner conductor. What is the diameter of the shield?

(exam continued on next page)

Question 4 (4 marks)

The diagram below shows the magnitude of the transfer function of a channel.

What is:

(a) the -10 dB bandwidth?

(b) the stopband attenuation?

(c) the output RMS voltage if the input is a 100 mVrms sine wave at a frequency of 4.5 kHz?

(d) the rolloff from passband to stop band in dB per octave?

Question 5 (2 marks)

The two graphs below show the magnitude and phase response respectively of a channel.

What is the maximum bandwidth of a baseband signal that can pass through the following channel without distortion? Briefly justify your answer.