Enrolment No:

UPES
UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, July 2020

Course: Information Theory and Coding **Semester: VI**
Program: B. Tech Electronics and Communication Engineering **Time 03 hrs.**
Course Code: ECEG 3025 **Max. Marks: 100**

Instructions:

1. Attempt all the questions (Theory, Numerical, Case study etc.) on A4 size blank sheets.
2. Attempt all questions serially as per question paper.
3. Answer should be neat and clean. Draw a free hand sketch for circuits/tables/schematics wherever required.
4. Scan the whole answer script and check the resolution carefully before upload on the blackboard. Note that answer scripts will be considered for evaluation only through Blackboard. No other mode of submission is acceptable.
5. You are expected to be honest about each attempt which you make to progress in life

SECTION A [40 Marks]

S. No.		Marks	CO
Q 1	A picture store on 20×5 matrix in a source has the following arrangements of the seven colors of Rainbow [**VIBGYOR**]. V I B R R Y G V I R R R V I G Y O O B Y O G G O R R Y Y Y G G Y I B Y B Y O B Y V I B B B G G Y Y Y O O O R R R R I I V V I B G V I B B B V V V V G G O Y O R R R R O O G G Y V V I I B B Y O G O G G R Find the code of **three primary colors** using **Huffman** coding.	**10**	**CO3**
Q 2	Find out the **channel capacity** of a 4 kHz line having a signal and noise power to be of 75W and 6dB respectively. If telephone channel (of bandwidth 100N kHz) support a maximum capacity of 5.1 kbps. Determine the minimum value of **SNR** supported by the channel. Here N is the last two numerical digit of your enrollment number.	**10**	**CO4**

NOTE : The submission time of the Question Paper Answer Sheet is 24 Hhrs from the scheduled time (*exceptional provision due to extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*).
No Submission will be entertained after 24 Hrs

Q 3	In a facsimile transmission of a picture, there are 2.25 M pixels per frame. For good reception, 12 equal probable brightness levels are necessary. Determine the **channel bandwidth** required to transmit one picture in every 3 minutes, the signal to noise ratio is 30 dB. If the signal to noise ratio requirement **increases** to 40 dB, calculate the bandwidth required for the transmission of the picture. Also state the **trade off** between **bandwidth** and **SNR** by comparing the results.	**10**	**CO4**
Q 4	A message signal is given as: $m(t) = 3 \cos 1000\pi t$. Determine (a) The signal to quantization noise ratio when this is quantized with 512 levels. (b) How many bits of quantization is required to achieve a **SQR** of at least 40 dB.	**10**	**CO1**
SECTION B [60 Marks]			
Q 5	State and prove **Shannon c**hannel capacity theorem.	**10**	**CO2**
Q 6	Draw the **AMI**, **B8ZS**, **B6ZS** and **HDB3** line coding waveform (voltage) for the binary sequence 11100000000101 and 101000000000000110111.	**10**	**CO 1**
Q 7	A source X has seven symbols represented as x_1, x_2, x_3, x_4, x_5, x_6 and x_7 with $P(x_1) = 0.37$, $P(x_2) = 0.33$, $P(x_3) = 0.16$, $P(x_4) = 0.07$, $P(x_5) = 0.04$, $P(x_6) = 0.02$ and $P(x_7) = 0.01$. Construct the **Shannon-Fano** code.	**10**	**CO2**
Q 8	The generator matrix for a (6, 3) block code is given below. Find all the **code vectors** for this code $\begin{bmatrix} 1 & 0 & 0 & : & 0 & 1 & 1 \\ 0 & 1 & 0 & : & 1 & 0 & 1 \\ 0 & 0 & 1 & : & 1 & 1 & 0 \end{bmatrix}$	**10**	**CO3**
Q 9	A rate 1/3 convolution encode has generating vectors as $V_1 = (1\ 0\ 1)$ and $V_2 = (1\ 1\ 1)$. Draw the **trellis** and **code tree** diagram.	**10**	**CO3**
Q 10	The generator polynomial of a (7, 4) **cyclic code** is $G(p) = p^3+p^2+1$. Determine the **code vectors** of first 10 message using **systematic cyclic code**.	**10**	**CO3**

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