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PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST-1

Even Semester: 2018-19 | **Date**: 5 March 2019

Course Code: PET 215 | **Time**: 01 Hour

Course Name: Natural Gas Engineering | **Max Marks**: 40

Programme & Sem: B.Tech (PET) & VI Sem | **Weightage**: 20%

Instructions:

(i) *Read the question properly and answer accordingly.*

(ii) *Question paper consists of 3 parts.*

(iii) Scientific and Non-programmable calculators are permitted.

Part A

Answer ***all*** Questions. **Each** question carries ***five*** marks. (3Qx05M=15)

1. Explain in brief about *types* of Natural Gas Resources (any five?)
2. Explain the sequence of *Flow-after-flow* test with help of neat diagram and notations?
3. Assuming the flow is fully turbulent with tubing diameter is 2.5 in. and relative roughness is 0.0007. Calculate:
   (a) Friction factor using Katz and Lee equation.
   (b) Friction factor using Guo equation.

Part B

Answer the Question. Question carries ***fifteen*** marks. (1Qx15M=15)

4. For the gas composition given in the following table 1, determine apparent molecular weight, gas specific gravity. Also find the pseudocritical pressure and pesudocritical temperature using:
   (a) Kay's mixing rule, and
   (b) Thomas et al.'s equations.

Component	C_1	C_2	C_3	C_4	C_5	N_2	CO_2	H_2S
Mole Fraction	0.795	0.110	0.025	0.003	0.004	0.007	0.004	0.043
Molecular Weight	16.04	30.07	44.10	58.12	72.15	28.02	44.01	34.08
P_{ci}	673	709	618	530	485	227	1080	660
T_{ci}	344	550	660	735	847	490	540	1300

Table.1

Part C

Answer the Question. Question carries ***ten*** marks. (1Qx10M=10)

5. A 0.65 specific gravity gas flows from a 2-in pipe through a 1.5-in nozzle-type choke. The upstream pressure and temperature are 300 psia and 40°F, respectively. The downstream pressure is 80 psia. The gas specific heat ratio is 1.3, choke coefficient is 1.1 and choke area is 0.98 in^2. Calculate:

(a) What is the expected daily flow rate?

(b) Does heating need to be applied to assure that the frost does not clog the nozzle?

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BENGALURU

SCHOOL OF ENGINEERING

TEST - 2

Even Semester: 2018-19 | **Date**: 15 April 2019

Course Code: PET 215 | **Time**: 1 Hour

Course Name: Natural Gas Engineering | **Max Marks**: 40

Program & Sem: B.Tech & VI Sem | **Weightage**: 20%

Instructions:

(i) Read the question properly and answer accordingly.

(ii) Question paper consists of 3 parts.

Part A

Answer the Question. The Question carries **ten** marks. (1Qx10M=10)

1. Draw a flow diagram of Glycol Dehydration Unit with proper notations.

Part B

Answer **both** Questions. **Each** Question carries **ten** marks. (2Qx10M=20)

2. Calculate the hourly gas flow rate for the conditions given as follows:

   Base Conditions: Gas field in Oklahoma, p_b = 14.65 psia, t_b = 60 °F

   Meter pipe: 4-in schedule 40 (4.026-in ID), flange taps, static pressure measured upstream taps.

   Orifice plate: Stainless steel, 1.5 inch measured at 20 °C.

   Recorder: 100-in water column differential, 1000 psia static spring.

   Readings:

   - Elevation: 450 ft
   - Atmospheric pressure: 14.5 psia
   - Flowing temperature: 95 °F
   - Gas-Specific gravity: 0.65
   - Differential pressure: 75-in water column
   - Static pressure: 750 psia

   Data: F_b: 460.000, b: 0.0336, Y: 0.9988, Z: 0.95, g: 32.100 ft/s^2

3. For a reciprocating compressor, calculate the theoretical and brake horsepower required to compress 50 MMcfd of a 0.7specific gravity natural gas from 200 psia and 70°F to 3200 psia. If the intercoolers cool the gas to 90°F, what is the gas temperature at first stage and final stage? Assuming the overall efficiency is 0.75

   Note: Number of iterations = 01

   Data:

   At 70°F

Pressure (psia)	100	200	400	600	800
Z	0.98	0.97	0.95	0.93	0.91

Part C

Answer the Question. The Question carries **ten** marks. (1Qx10M=10)

4. Calculate the minimum required size of a standard oil/gas separator for the following conditions. Consider both vertical and horizontal separators.

   Data:

   - z: 0.85
   - Gas density: 3.5 lbm/ft^3
   - Inner diameter of vessel: 2 ft
   - K-values: 0.205 (Vertical separator), 0.45 (Horizontal separator)
   - Liquid settling volume, bbl: 0.65 (Vertical separator), 0.61 (Horizontal separator)
   - Gas flow rate: 4.0 MMscfd
   - Gas-specific gravity: 0.7
   - Condensate-gas ratio (CGR): 15 bbl/MMscf
   - Condensate gravity: 65° API
   - Operating pressure: 600 psig
   - Operating temperature: 70 °F

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END TERM FINAL EXAMINATION

Even Semester: 2018-19 | **Date**: 24 May 2019

Course Code: ECE 213 | **Time**: 3 Hours

Course Name: Digital Signal Processing | **Max Marks**: 80

Program & Sem: B.Tech ECE (IV Sem) / EEE (VI Sem) | **Weightage**: 40%

Instructions:

(i) Read the question properly and answer accordingly. Question paper consists of 3 parts.
(ii) Scientific and Non-programmable calculators are permitted.
(iii) Exchange of calculators is not allowed.

Part A

1. Answer **all** the Questions. **Each** question carries **one** mark. (10Qx1M=10M)

i. The Nyquist theorem for sampling can be applied
   a) To help in quantization b) only if the signal is band-limited
   c) even if signal is not band-limited d) To help in encoding

ii. Sampling process converts a CT signal x(t) into a DT signal x[n] by substituting
   a) t = nT b) t = n/ T c) n=t/T d) t= (n-1)/T

iii. The relation between analog frequency (Ω) and digital frequency (ω) variable is
   a) Ω = ωT b) Ω = (ω+π)T c) ω =(Ω-π)T d) ω = ΩT

iv. The condition for the Butterworth filter to be a stable and causal filter is that the poles should be selected in the
   a) left half of S-plane b) right half of S-plane
   c) either left half or right half d) neither left half nor right half

v. Which filter has equiripple characteristics in pass band and monotonic in stop band?
   a) Butterworth filter b) elliptic filter
   c) Chebyshev Type-1 filter d) Chebyshev Type-2 filter

vi. The disadvantage in impulse invariance technique while mapping the poles from S-plane to Z-plane is
   a) one-to-one b) linear c) many-to-one d) many-to-many

vii. A digital filter is described mathematically by using a
   a) Differential equation b) Difference equation
   c) parabolic equation d) quadratic equation

viii. The product of two DFTs in frequency domain is equivalent to ---------- of sequences in time domain?
   a) Linear convolution b) circular convolution c) periodicity d) symmetry

ix. The number of complex multiplications using radix-2 FFT algorithm is calculated by
   a) $N \log_2 N$ b) $2N \log_2 N$ c) $\frac{N}{2} \log_2 N$ d) $\frac{N^2}{2} \log_2 N$

x. The number of delay elements needed for realizing Canonic Direct Form of IIR filter with M+1 zeros and N poles is
   a) M+N+1 b) M+N c) min (M,N) d) max (M,N)

2. Answer **all** the Questions. **Each** question carries **two** marks. (5Qx2M=10M)

i. For a 16-point DFT, the number of multiplications and number of additions is --------- and ---------.

ii. Parseval's theorem in DFT is stated as $\sum_{n=0}^{N-1} |x[n]|^2$ = ----------

iii. The formula to find IDFT of a sequence is ---------- and Twiddle Factor is defined as W_N = ----------

iv. The formula to find the order of Butterworth filter is ----------

v. The necessary and sufficient condition for an FIR filter to have linear phase is that the impulse response h[n] must be of ---------- duration and must be ---------- about its mid point.

Part B

Answer **all** the Questions. **Each** question carries **eight** marks. (3Qx8M=24M)

3. Determine the 8-point DFT of the sequence x[n] = {1, 2, 3, 4, 1, 0, 1, 2} using Radix-2.

4. Decimation-in-Frequency FFT algorithm. Find the Magnitude Spectrum of X(k)?

6. Using Impulse Invariance Technique, derive the condition for mapping of poles from S-Plane to Z-Plane for the analog filter Transfer Function $H(S) = \sum_{i=1}^{N} \frac{A_i}{S-P_i}$

8. A. Realize using Direct Form-2 structure for the system function described as,
$H(z) = (5 - 3\,z^{-1} + 2\,z^{-2}) / (1-0.5\,z^{-1} + 0.25\,z^{-2})$ (4)

B. Draw the Direct Form structure of an FIR filter whose impulse response is
$h[n] = \delta[n] + 0.8\,\delta[n-1] + 0.5\,\delta[n-2] + 0.125\,\delta[n-3]$ (4)

Part C

Answer **all** the Questions. **Each** question carries **twelve** marks. (3Qx12M=36M)

7. Design an analog low pass filter with the following specifications:
   i. Filter has equi-ripple characteristics in passband and monotonic characteristics in stopband.
   ii. Maximum passband attenuation of 2.5 dB and the stopband attenuation of 30 dB.
   iii. Passband frequency of 20 rad/sec and a stopband frequency of 50 rad/sec.

8. Design and realize a digital low pass filter using bilinear transformation to satisfy the following:
   i. Monotonic stop band and pass band.
   ii. -3.01 dB cut-off frequency at 0.5π rad and
   iii. Magnitude down by at least 15 dB at 0.75π rad.

9. The desired frequency response of a low pass filter is given by,

$$Hd(e^{j\omega}) = Hd(\omega) = \begin{cases} e^{-j3\omega}, & for\ |\omega| < \frac{3\pi}{4} \\ 0, & for\ \frac{3\pi}{4} < |\omega| < \pi \end{cases}$$

Determine the frequency response of the FIR filter, if Hamming window is used with N=7?

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SUMMER TERM / MAKE UP END TERM EXAMINATION

Semester: Summer Term 2019
Course Code: PET 215
Course Name: Natural Gas Engineering
Program & Sem: B. Tech (PET) & VI Sem (2015 Batch)

Date: 23 July 2019
Time: 2 Hours
Max Marks: 80
Weightage: 40%

Instructions:

(i) Read the question properly and answer accordingly.

(ii) Question paper consists of 3 parts.

(iii) Scientific and Non-programmable calculators are permitted.

Part A

Answer the Question. **The** question carries **ten** marks. (1Qx10M=10)

1. What are the purposes of Pigging? Write about three pig selection criteria.

Part B

Answer **both** the Questions. **Each** question carries **twenty** marks. (2Qx20M=40)

2. Explain any three problems associated with Natural Gas Production.
3. Write short note on the following **(any four)**
   (i) Cleaning Pig
   (ii) Gauging Pig
   (iii) Displacement Pig
   (iv) Intelligent Pig
   (v) Caliper Pig

Part C

Answer the Question. **The** question carries **thirty** marks. (1Qx30M=30)

4. Write any four advantage and disadvantages of Glycol dehydrator. What are the problems associated with long distance transmission of Natural Gas which contain water? Explain Glycol dehydration unit with a suitable flow chat.