Name: SAP ID:	**UPES** UNIVERSITY WITH A PURPOSE

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

Course: Production Engineering & Well Testing & Analysis   **Semester:** 2nd
Program: M.Tech Petroleum Engineering   **Time:** 03 hrs.
Course Code: PEAU7006   **Max. Marks:** 100
No. of Pages: 8

Note:

1. Read the instruction carefully before attempting.
2. This question paper has two section, Section A and Section B.
3. There are total of five questions in this question paper. One in **Section A** and four in **Section B**

4. **Section A** consist of multiple choice based questions and has the total weightage of 60%.
5. **Section A** will be conducted online on BB Collaborate platform
6. **Section B** consist of long answer based questions and has the total weightage of 40%.
7. The maximum time allocated to **Section A** is two Hrs.
8. **Section B** to be submitted within 24 hrs from the scheduled time (*exceptional provision due extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*).
9. No submission of **Section B** shall be entertained after 24 Hrs.
10. **Section B** should be attempted after **Section A**
11. **The section B** should be attempted in blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, Sapid at the top (as in the format) and signature at the bottom (right hand side bottom corner)

SECTION A (Attempt all the questions)
(60 × 1 = 60 marks)

Q1. Attempt following multiple choice questions: -   (CO2)
   i.   As a production engineer, for offshore well we prefer a minimum productivity index value of
           _____ bbl/day-psi.

           a) 0.1   b) 0.5   c) 0.2   d) 0.3

   ii.   The graph of IPR of a single phase oil reservoir is _____
           a) parabolic   b) hyperbolic   c) elliptical   d) straight line

   iii.   A well produces 100 STB/day oil at a measured flowing bottom hole pressure (BHP) of 1500 psi. A
           recent pressure survey showed that average reservoir pressure is 2000 psi. Logs indicate a net sand

thickness of 10ft. The well drains an area with drainage radius of 1000ft; the bore hole radius is 0.25 ft. Fluid samples indicate that, as current reservoir pressure, oil viscosity is 0.5 cP and formation volume factor is 1.5 rB/STB. Estimate formation permeability (mD). Assume pseudo steady flow of fluids in a radial acting reservoir.

a) 16   b) 25   c) 40   d) 93

iv.   An oil well is producing from a circular drainage area of radius 750 ft. Assume reservoir pressure of 2000 psig, permeability of 40 mD, pay zone thickness of 20 ft, oil viscosity of 3 cP, oil formation volume factor of 1.2 rB/ STB and radius of wellbore is 0.5 ft. For a flowing bottom-hole pressure of 500 psig, the primary production rate is _____ STB/day. Assume steady state flow of fluids.

a) 765   b) 323   c) 678   d) 234

v.   Formation permeability is determined from _____ region of Horner's plot for a pressure build-up test.
        a) late time   b) middle time   c) early time   d) none of these

vi.   As a production engineer, for onshore well we prefer a minimum productivity index value of _____ bbl/day-psi.

a) 0.1   b) 0.4   c) 0.8   d) 1.0

vii.   During a production test in an oil reservoir, the oil production rate is 300 STB/day. The producing gas oil ratio is 600 scf/STB and dissolved GOR is 100 scf/STB. The formation volume factor of gas is 0.02 ft^3/SCF. Calculate the down-hole free gas production rate (ft^3/day).

a) 4000   b) 2000   c) 3000   d) 5000

viii.   State the type of pump used in surface production facility

a) duplex   b) triplex   c) reciprocating   d) centrifugal

ix.   Productivity index is defined as ratio of

a) reservoir pressure to flow rate   b) flow rate to pressure drawdown
c) flow rate to flowing bottomhole pressure   d) flowing bottomhole pressure to reservoir pressure

x.   Vogel's equation is applicable for

a) under saturated oil reservoir   b) 3 phase reservoir   c)   2 phase oil reservoir   d) none of these

xi.   Which of the following clay type swells more when it encounters water?

a) kaolinite   b) smectite   c) chlorite   d) illite

xii.   Coning in horizontal wells is called

a) cusping   b) jetting   c) cresting   d) none of these

xiii.   Which of the following factors should be considered in tubing design?

a) Tubing size, weight and grade   b) Well conditions   c) Completion methods   d) above all

xiv.   The process of making a well ready for production (or injection) is called

 a) workover   b) well completion   c) well stimulation   d) well intervention

xv.   A vertical well is drilled in an oil reservoir underlain by bottom aquifer. The following reservoir data is given. Difference between water and oil density is 0.48 g/cm3 ; permeability = 200 mD ; oil column thickness is 80 ft ; perforated interval thickness is 8 ft ; oil viscosity is 0.4 cP ; oil formation volume factor is 1.32 rB/STB ; drainage area is 80 acres; wellbore radius is 0.25 ft. Calculate critical oil production rate in bbl./day.
a) 712   b) 212   c) 312   d) 512

xvi.   In _____, light gases are separated due to reduction in pressure.

a) Flash separation   b) differential separation c) both a & b d) none of these

xvii.   Pressure range for medium pressure separator varies from

a)   240 to 260 psi b) 740 to 760 psi   c) 1400 to 1600 psi   d) none of these

xviii. Coriolis flowmeter measures _____

a) Mass flow rate   b) volumetric flow rate   c) pressure d) none of these

xix.   Positive displacement meter measures _____

a) Mass flow rate   b) volumetric flow rate   c) pressure d) none of these

xx.   Stokes law is mathematically represented as

a) $C_d = 48/Re$ b) $C_d = 24/Re$ c) $C_d = 72/Re$ d) $C_d = 96/Re$

xxi.   Retention time for a heater treater varies from

a) 70 to 80 minutes   b) 2 to 5 minutes   c) 10 to 30 minutes   d) 110 to 130 minutes

xxii.   _____ may be used to transfer waste heat from compressors to a heating fluid medium

a) Gun barrel   b) heat exchanger   c) heater treater   d) turbine meter

xxiii. Free water knockout operates at pressure range of

a) 30 to 50 psig   b) 70 to 80 psig   c) 100 to 120 psig   d) 150 to 170 psig

xxiv.   Which among the following equipment is generally not used in offshore production operations because of large footprint

a) Gun barrel   b) heat exchanger   c) heater treater   d) FWKO

xxv.   Liquid re-entrainment is likely to occur at

a) Low operating pressure and low viscosity of oil
b) High operating pressure and high viscosity of oil
c) Low operating temperature and low viscosity of oil
d) High operating temperature and low viscosity of oil

xxvi.   One impurity that almost always causes foaming of crude oil is

a) CO   b) CO_2 c) NO_2 d) H_2S

xxvii. Which among the following is not a type of mist extractor.

a) Vane   b) Wire mesh   c) microfiber   d) vortex breaker

xxviii. _____ is a device that provides large liquid holding volume and routes the liquid to a 3-phase free water knockout for further liquid-liquid separation.

a)   Scrubber   b) Cyclone baffle   c) slug catcher   d) heater treater

xxix.   _____ is a phenomenon in which the performance of entire system is limited by a single or small number of components

a) Nodal analysis   b) bottleneck   c) system breakdown   d) Plant shutdown

xxx.   In mist extractor section liquid droplets of size _____ microns is removed by mist extractor

a) More than 10000   b) 100 to 140   c) less than 100   d) 1 to 4

xxxi.   Horizontal separator is normally used in _____

a) High GOR and foaming crude oil b) High GOR and non-foaming crude oil

c) Low GOR and foaming crude oil   d) Low GOR and non-foaming crude oil

xxxii. Vertical heater treater is fitted with a _____, between the baffles, which aids in coalescence of H_2O droplets.

a) Surge chamber   b) water washer   c) Excelsior   d) Tretolite

xxxiii. Pressure range for low pressure separator varies from

a) 240 to 260 psi b) 740 to 760 psi   c) 1400 to 1600 psi   d) none of these

xxxiv. Pressure range for medium pressure separator varies from

a) 240 to 260 psi b) 740 to 760 psi   c) 1400 to 1600 psi   d) none of these

xxxv. Emulsion breaking chemicals are most commonly tested with a _____

a) Fugitive test b) Bottle test   c) Leak off test   d) pressure build-up test

xxxvi. The temperature reduction in low temperature separator is obtained by

a) Joule Thomson effect b) Peltier effect   c) gravity effect   d) none of the above

xxxvii. _____ are used to cause the initial bulk separation of liquid and gas in a separator

a) Inlet diverter b) wave breaker   c) defoaming plates   d) none of the above

xxxviii.   Wave breakers are generally used in

a) Horizontal separators b) vertical separators   c) both a & b   d) none of the above

xxxix. Which of the following influence the rate of breakdown process in emulsions?

a) Flocculation   b) sedimentation   c) coalescence   d) all of the above

xl.   An oil emulsion is _____?

a) A heavy viscous liquid

b) a heavy viscous liquid containing a large amount of entrained sediment

c) An oil & water mixture that does not readily separate

d) A layer of free water located above a heavy viscous petroleum product

xli.   In cationic surfactants, cations will normally:

a) Emulsify water in oil   b) Disperse clays or fines in oil   c) Flocculate clays in water   d) All of the above

xlii.   Which of the following acid is not used in well stimulation
        a) Formic acid
        b) Acetic
        c) Sulfamic acid
        d) Sulphuric acid

xliii. The consequences of chemical incompatibility of chemicals used in acidization will be
        a) Formation damage
        b) Formation fracture
        c) Tremendous increase in pressure
        d) All of the above

xliv.   While pumping acid in to the formation during acidization , acid can penetrate inside the formation up to the length of
        a) 4 ft.
        b) 20 ft.
        c) 100 ft.
        d) Up to the drainage radius of the reservoir

xlv.   Which of the following acid is suitable for the treatment of carbonate reservoir
        a) Hydrofluoric acid
        b) Hydrochloric acid
        c) Formic acid
        d) Mud acid

xlvi.   Ethylene diamine tetra acetic acid is a chemical used in oil industry

a)   As a Chelating agents to prevent the precipitation of damaging compounds.
b)   As a chelating agents for stimulation treatments
c)   To treat or remove scale in reservoir drilling fluids.
d)   All of the above

xlvii. Mud acid is used for acid job in
        a) Sand stone reservoirs
        b) Carbonate reservoir
        c) Both sand stone and carbonate reservoirs
        d) None of the above

xlviii. Maximum concentration of hydrochloric acid used in acidization is
a)   5 %
b)   10%
c)   15%
d)   40%

xlix.   Find the statement that is not correct. The acidization in a well bore is done

a) To dissolve and/or disperse materials near the wellbore that impair well production
b) To create new, unimpaired flow channels between the wellbore and formation.
c) To increase the permeability of the formation
d) None of the above

l. _____ is opening of new channels in the rock for oil and gas to flow through easily.
a) Well stimulation
b) Well glancing
c) Formation evaluation
d) Well cleaning

li. Why do we use pseudo-pressure for gas wells in particular?
a) we could use pressure or pseudo-pressure for gas wells, it doesn't matter
b) because total compressibility depends on pressure
c) to linearize the flowing equations
d) Just to make well test analysis more difficult and complex.

lii. What are the assumptions when analysing a shut-in period?
a) Superposition works
b) The flow period in particular before the PBU reaches and ends in radial flow regime
c) Short shut-in duration compared to production time
d) All of the above

liii. Which tool do we generally use to drive our well test analysis?
a) The DP plot
b) The derivative
c) The superposition plot
d) The data plot showing pressure and rate versus time

liv. Which of the following is the example of homogeneous flow model?
a) Poetmann and Carpenter correlation
b) Lockhart and Martinelli correlation
c) Duns and Ross Correlation
d) None of the above

lv. Which of the following is the example of separated flow model?
a) Poetmann and Carpenter correlation
b) Guo and Ghalambor correlation
c) Hagedorn and Brown Correlation
d) None of the above

lvi. Which flow pattern is expected if the entire zone of interest is perforated?
a) Radial
b) Linear
c) Spherical
d) Both a & b are possible

lvii. In _____ flow the larger gas bubbles become unstable and collapse, resulting in a highly turbulent flow pattern with both phases dispersed
a) Slug
b) Churn
c) Bubble
d) Annular

lviii. Out of the following, which pressure is the highest in a flowing well
a) Well head tubing pressure
b) Flowing bottom hole pressure
c) Static bottom hole pressure
d) None of the above

lix. Undersized tubing will result in
a) Higher wellhead pressure than optimum
b) Higher bottom-hole pressure than optimum
c) Lower bottom-hole pressure than optimum
d) Need more information

lx. In oil well design, prediction of multiphase flow pressure drop is helpful for
a) Deciding on tubing size
b) Deciding on flow line size
c) Both of the above
d) None of the above

SECTION B (4 x 10 = 40 mark)

Instructions:
1. Neat diagrams must be drawn
2. Use a non-programmable calculator

Q 2	Explain Drill Stem Test performed to confirm commercial quantity of hydrocarbon in exploratory wells	10	CO4
Q 3	Elaborate about Pressure buildup test well testing technique performed in an oilfield. Also state the Horner equation and its significance with a suitable diagram	10	CO3
Q 4	a) What is reservoir limit testing? State the reservoir properties that may be determined from these tests? b) What is wellbore storage effect? State any two type of storage effect.	10	CO4
Q 5	Derive the mathematical equation for pressure transmission in a porous medium filled by slightly compressible fluid	10	CO4