Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, December 2020

Course: Artificial lift technology **Semester: V**
Program: B. Tech. APE upstream **Time 03 hrs.**
Course Code: PEAU 3023 **Max. Marks: 100**

SECTION A

1. **Each MCQ will carry 1 mark**
2. **Instruction: Select the correct option**

Q1. CO1

1. Which of the following is true about gas lift?

   a. Gas lift is a hydrostatic process of lifting gas from a well book
   b. Gas lift is a chemical process of lifting the fluid from well bowl
   c. Electromagnetic process of lifting the fluid from the wellbore
   d. None of the above

2. Which of these are mostly used in Offshore well?

   a. Rod pump and ESP
   b. ESP sat PCP
   c. Gas lift and ESP
   d. PCP and gas lift

Q2.

3. The working principle of gas lift is to

   a. Reduce reservoir pressure
   b. Reduce surface pressure
   c. Increase bottom hole pressure
   d. none of the above

4. For high volumes of fluid transmission through a pipe line, which of these is recommended

   a. Duplex pumps
   b. triplex pumps
   c. screw pumps
   d. All of the above

5. Rod pump are best suited for

   a. Deep Offshore vertical well
   b. Horizontal well
   c. Extended reach wells
   d. None of the above

Q3.

6. Which one of these is not a type of artificial lift used in the oil industry

a. Hydraulic Jet pumping
b. Hydraulic Piston pumping
c. Electric synchronous pump
d. Plunger lift pump

7. Which of these parameters is most relevant to get lift operations

a. GOR
b. GLR
c. WOC
d. GOC

Q4.

8. The working principle of of the progressive cavity pump is similar to that of

a. Reciprocating pump
b. Triplex pumps
c. Duplex pumps
d. Screw pumps

9. Optimization of the sucker rod pumped well mainly focuses on

a. Reducing the diameter of the rod
b. Increasing the pump speed
c. Increasing the energy efficiency
d. Reducing the rod length

10. Which of these is not correct. Over injection of gas lift gas can result in

a. Sand Production
b. High cost
c. Lower oil production rate
d. None of the above

Q5.

11. Choose the correct option among the four

a. The larger the tubing size the higher the well deliverability
b. Small tubing always reduces the gas lift effect in oil Wells
c. The optimal tubing size yields the highest frictional pressure and the maximum production rate
d. Large tubing could result in liquid loading of gas Wells

12. Electrical submersible pumps are

a. Centrifugal pumps in multistage fashion
b. Positive displacement pump
c. Reciprocating pump
d. None of the above

Q6.

13. The most critical component of a PCP is is

a. Rotor
b. Motor
c. Sucker rods
d. Elastomer in the stator

14. Gas lift Optimization curve is plotted with

a. Liquid production and wellhead pressure
b. Liquid production and gas injected
c. Gas injected and formation gas
d. None of the above

15. ESP is basically suited for

a. Low volumes of well fluids
b. Sand laden well fluids
c. High volume of well fluids
d. None of the above

16. Which of the following statement is incorrect?

a. Maintaining production rates can be achieved by fluid injection
b. Artificial lift processes can maintain or enhance production rates
c. Gas lift reduces the frictional pressure loss in tubing to assist production
d. Reservoir recovery performance and production rate profile is controlled by the reservoir drive mechanism

17. Using gas lift method which pressure loss can be reduced for an optimised production

a. Hydrostatic pressure loss
b. Kinetic pressure loss
c. Friction pressure loss
d. None of these

18. _____ Compressors are usually used with electrical submersible pumps and rod pumps where formation gas is required to be separated downhole and then transported through the annulus

a. Casing head
b. Vapour recovery
c. Gas lift
d. Flash gas

19. If the loading element is spring, the valve will be _____ side fluid operated

a. Casing
b. Tubing
c. Rod
d. Spread

20. Production capabilities of intermittent lift depends on

a. Starting load
b. Lift efficiency
c. number of cycles per day
d. Both a and b
e. all a, b and c

21. Types of reciprocating pumps used in oil industry are _____, _____ and _____.

22. Types of rotary pumps used in oil industry are _____, _____, _____, _____ and _____.

23. Draw head vs. Flow rate performance curve for a reciprocating pump.

24. Spacing of gas lift valves depends on _____, _____ & _____

SECTION B

1. **Each question will carry 10 marks**
2. **Instruction: Write short / brief notes**

Q 2

1. What type of gas lift installation would you recommend for the wells specified in the following table?

CO4

Well	Depth (ft.)	Productivity Index	Separator pressure (psig)	Fluid gradient (psi/ft.)	Static BHP (psig)
A	7000	10	50	0.5	3000
B	2200	0.1	10	0.35	250
C	5000	2	30	0.4	200
D	6000	0.02	100	0.35	2500
E	1500	0.5	10	0.33	65
F	500	0.1	0	0.33	10

Q 3	a) What is the fundamental difference between pumping method (SRP, ESP) and gas lift method of artificial lift techniques? Explain with diagram. b) A sucker rod pump unit is designated by C-228D-200-74. What does '228' ,'200', '74', 'C' & 'D' represents here?	**CO4**
Q 4	a) A well is producing under gas lift with following given data: Solution GOR = 400 scf/bbl Produced GOR = 800 scf/bbl The well is optimized to produce 400 bbl/day of liquid. Calculate the amount of injected gas (Mscf) required to maintain the production. b) Suppose a casing operated, pressure valve is located at 8000 ft. The pressure in the dome is 700 psi and tubing pressure is 500 psi at 8000 ft. Find the casing pressure (psi) required to open the valve if area of bellows = 2 sq. in. and area of Port = 0.4 sq. in.	**CO3**
Q 5	a) For a sucker rod pump following specifications are given. Length of crank arm = 25 inch and length of pitman arm = 100 inch. Calculate the ratio of maximum acceleration of rod to the minimum acceleration of the rod. b) Draw a typical pump performance curve for electrical submersible centrifugal pump for head capacity, pump efficiency and brake horsepower with respect to oil flow rate: - c) Calculate the total dynamic head for an electrical submersible pumping to be used for a well to produce 2000 STB/day of oil assuming that water cut is zero in the well. Following data are available: Well depth (perforation level) = 2200 ft. Static fluid level (from the surface) = 500 ft. Productivity Index of well = 4 bbl/day/psia Wellhead pressure = 150 psia Tubing frictional losses = 18.5ft per 1000ft of the lift Specific gravity of oil = 0.85	**CO3**

Q 6	a) A 10,000-ft-deep well having oil with density 7.20 ppg, is to be produced at a flowing bottom hole pressure of 2300 psi with an ESP when the average reservoir pressure is 4350 psi. The well will be equipped with 2 7/8-in. tubing. The surface tubing pressure is 100 psig, and the well casing is 7 in. The pump is set at 9800 ft. Calculate the pump suction pressure (psi). b) Assume a casing operated pressure valve is located at 7500 ft. The pressure in the dome is 750 psi at 9000 ft. Find the maximum limit of casing pressure required to close the valve, if area of bellow = 1.5 sq. in. and area of port = 0.3 sq. in. c) Classify the types of compressor used in oil and gas industry:- OR a) For a well-polished rod, stroke length is 68 in., pumping speed is 16 spm, and length of the sucker rod string is 6898 ft. What would be the increase in effective plunger stroke if pumping speed were increased to 20 spm? (take Modulus of elasticity of steel as 30×10^6 psi) b) 1-inch sucker rod weighs 2.7 lb/ft. The pumping speed of SRP is 20 spm and the polish rod stroke length is 74 in. Calculate the integer value of maximum polished rod load (lbs) resulting from 1000 ft of one inch sucker rods. Consider the case of fluid Pound.	**CO2**

Section C

1. **Question carries 20 Marks.**
2. **Instruction: Write complete solution**

Q 7	a) Derive opening & closing pressure of continuous gas lift by force balance for valve under operating conditions? b) Calculate the integer value of pump speed (strokes/min) needed to produce 200 STB per day of oil at surface with a rod pump having 2 inch diameter plunger. The effective plunger stroke length is 50 inch and volumetric efficiency is 80%. Assume oil formation volume factor = 1.2 rb/STB. c) An 11500 ft deep oil well having flowing bottomhole pressure 2200 psi, is producing 242 bbl per day. Artificial lift engineer wants to install electrical submersible pump in the Well. Calculate the operating depth (in feet) below which the ESP need to be installed if the minimum suction pressure of ESP is 250 psi. API gravity of crude oil is 20 degree. OR a) The following geometric dimensions are for the pumping unit C-320D-213-86: X = 96.05 inch Y = 121 inch C = 35 inch C/H = 0.33 Where: X represents distance between fulcrum and Crank Y represents distance between fulcrum and polished rod C represents length of crank arm H repesents length of pitman arm Calculate polished rod stroke length (inch). b) Define test rack opening pressure. Explain the concept of gas lift valve calibration. c) Explain intermittent gas lift operation. Elaborate about stages of injection gas breakthrough & liquid fallback.	**CO4**