SET I

Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Economics of Oil and Gas Sector — **Semester: IV**
Programme: BA LLB. (HONS.) ENERGY LAWS 2017 - Batch I & II — **CC: CLNL 2013**
Time: 03 hrs. — **Max. Marks: 100**
Instructions:

SECTION A

S. No.		Marks	CO
Q 1	**Fill in the blanks: (10 marks)** 1. Well fluid is a combination of …………, ……….. and …………. (3 marks). 2. Natural gas in bulk is liquefied under very low (cryogenic) temperature for transportation in large quantities by marine tankers to form ………...(1 marks) 3. Propane and Butane is a composition of……………. (1 marks) 4. …………….. is the lightest crude amongst the crude oil of 40 API, 35 API and 25 API. (1 marks) 5. …………… is used as feedstock for making Petrochemical from Refinery. (1 marks) 6. The first exploratory well drilled in a field is called …………..(1 marks) 7. Full form of GGS is ……………..(1 marks) 8. One barrel holds ……….. gallon of crude oil. (1 marks)	**10**	**CO 1**

SECTION B

Q 1.	Produced Water is separated from various separators and oil treaters in the oil field Explain the produced water treatment with the help of a diagram?	**5**	**CO 1**
Q 2.	Explain the difference between Contractual and Concessionary Agreement and the role of Government in each	**5**	**CO 2**
Q 3.	Explain the role of DGH and PNGRB in the oil and gas sector	**5**	**CO 3**
Q 4.	What is Crude Oil benchmark? Explain the three major benchmarks of the crude oil?	**5**	**CO 1,2**

SECTION-C

Q 1.	Upstream, Midstream and Downstream are the terms which are very frequently used in the petroleum industry. In light of the above statement, Explain oil and gas chain	**10**	**CO 1**

	with the help of block diagram?		
Q 2.	Strategic Petroleum reserves have proved to be a boon globally? Does India need Strategic Petroleum reserves?	**10**	**CO 3**
	SECTION-D		
Q1.	You are a geophysicist of an organization ABC Pvt. Ltd. who is into the business of Exploration and Production. The organization has recently acquired a block in KG Basin KGB-12D4. Due to the non-availability of the technical staff, your organization has recruited a set of engineers from IIT-Mumbai. Your director (Technical) has asked you to make an induction course material on various activities involved in Exploration and Production. Illustrate and explain the same accordingly.	**20**	**CO 3**
Q2.	**Refer the case "Transporting Crude Oil by Rail in Canada" and answer the following questions** 1.) Explain the market dynamics driving the rapid increase in crude-by-rail shipments across North America. 2.) Explain the economics of transporting crude oil by rail. 3.) Compare the different requirements for transporting light crude oil, heavy crude oil, and bitumen. **Introduction** Historically, crude oil in North America has been primarily transported by pipelines, however pipeline capacity from the major supply regions to markets is currently tight. The Canadian crude oil industry faces a 3 to 5 year period of constrained pipeline capacity given the current status of proposed major crude oil expansions such as Keystone XL, the Trans Mountain Expansion, Enbridge's Northern Gateway Project and TransCanada's proposed Energy East Pipeline. None of these projects are yet in the construction phase and some still face protracted regulatory proceedings. As a result, the use of rail tank cars to transport crude oil has increased rapidly over the past several years and growth in demand for rail capacity is expected to continue in the near future with significant loading capacity coming into service before 2016. In Canada, with respect to crude oil, the Canadian rail industry is evolving from a manifest system, in which trains might have to make multiple stops to deliver different products, to a unit system, in which trains go directly from the point of origin to the point of destination. Most of the large scale facilities that can load a unit train will be moving heavy oil, dilBit, rail bit or raw (undiluted) bitumen.The rapid growth in rail traffic for crude oil transportation and a number of high profile train incidents has elevated public concern related to safety with this mode of transportation. As a result, regulatory agencies in both the U.S. and Canada have taken steps to address such concerns and are expected to impose new standards in the near future directed towards improving safety associated with transporting crude oil by rail. It is anticipated that there will be a harmonization of any new regulations in both Canada and the U.S. due to the cross border movement of railcars. The safety review will focus on two priorities 1) accident prevention and 2) preparedness and	**30**	**CO 3**

response in an event of an accident.

2 Rail Capacity and Outlook in Canada

The level of transportation of crude oil by rail in Canada was almost 200,000 b/d by the end of
2013. In comparison, the North Dakota Pipeline Authority estimated rail transportation from North Dakota to have reached around 760,000 b/d during the same period, which is an indication of the potential size of rail capacity. There is evidence of significant investments in infrastructure occurring in western Canada suggesting growth in capacity. Several large unit train loading facilities have been announced for western Canada that could be operational by the end of 2015.

2.1 Western Canada Rail Loading Capacity

As a result of a number of new facilities and minor expansions coming into service throughout
2013, the rail loading capacity originating in western Canada has now increased to 300,000 b/d.

At the beginning of 2013, capacity was only about 180,000 b/d. The first capacity additions involved smaller facilities that loaded crude oil along with other commodities on manifest trains directly from truck to rail car. Some later projects incorporate storage capacity which helps movement of larger shipments of oil since it is logistically more efficient for truck shipments to be loaded to storage tanks and then from storage tanks to rail. Other recent developments are for dedicated unit train facilities. These facilities can directly fill unit trains via pipeline or out of tank farm storage.

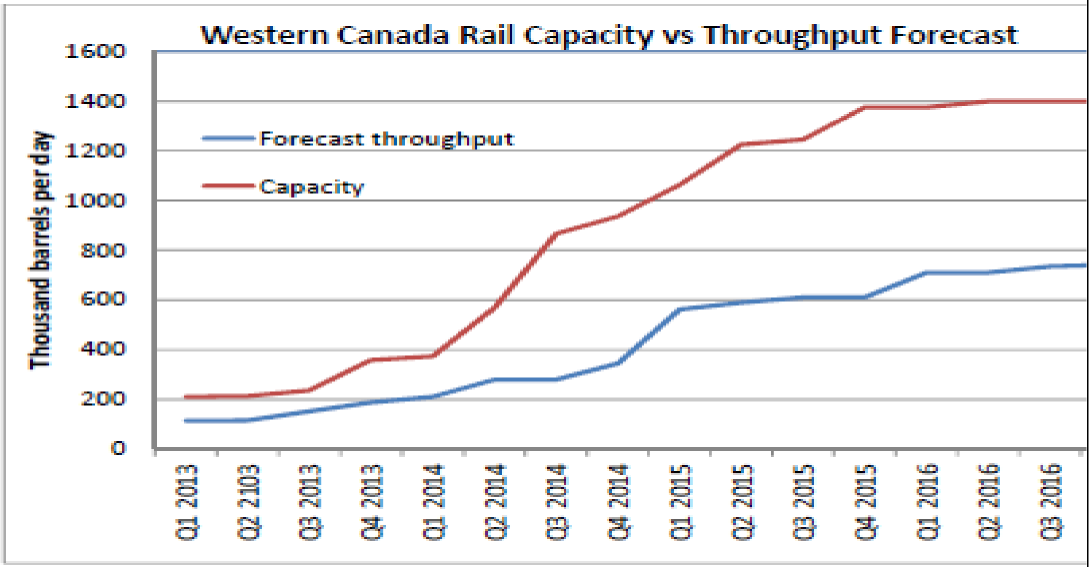
By the end of 2015, western Canadian rail uploading capacity for crude oil is expected to exceed
1.0 million b/d. Several proposed facilities can be further expanded beyond the initial stated capacity so it is conceivable that rail capacity could be expandable to 1.4 million b/d.

The earliest loading terminal facilities in western Canada were constructed in the Bakken play areas located in Saskatchewan and Manitoba and were built for shipping light crude oil out of the region. The newer projects being announced are generally larger facilities and are located closer to the oil sands producing areas and consequently will provide heavy crude uploading capacity.

2.2 Crude by Rail Throughput

Actual volumes of crude oil being moved by rail are generally lower than design capacity at loading facilities. However, it is important to note that the definition of capacity is not very standardized and there are a number of limiting factors on actual capacity that include: supply connections, system bottlenecks, operational inefficiencies, limited hours of operation, and ramp up time required to achieve full utilization. CAPP forecasts crude oil volumes transported by rail will increase from about 200,000 b/d in late 2013 to 700,000 b/d by the end of 2016. It is important to note that most of the large scale terminals are underpinned by long term take or pay contracts which should encourage utilization. Constraints on capacity include unloading time and weather. The load factor utilization should improve over time, however, particularly as producers and operators become more experienced with this mode of transportation.

Figure 2-2 Western Canada Terminal Uploading Capacity vs Throughput Forecast



2.3 Factors Impacting Capacity and Throughput

A number of factors determine the amount of crude oil that can be transported in a given rail car:

· ***Terminal setup***: New terminals are generally more efficient than older terminals. However,
new terminals may be constructed as a loop track or a ladder track each coming with certain
advantages and disadvantages.

Hours of operation: Some terminal sites may not operate 24 hours a day, 7 days a week.

· ***Type of crude***: Given the maximum allowable weight for a tank car and since heavy crude oil
is more dense and has a higher viscosity than light crude, if all other factors are the same,
lower volumes of heavy crude can be transported in a given car. Note that there is also more
time required in the process to unload raw bitumen off a heated and coiled rail car. Steam
must be passed through the coils for up to 24 hours to enable the bitumen to flow.
Consequently, the movement of shipment of heavy crude oil would require a longer cycle
time for the rail cars.

· ***Type of tank car:*** Fully loaded tank cars have a weight restriction of 286,000 lbs. Older cars
built prior to October 2011 were constructed based on a gross rail load (GRL) of 263,000 lbs.
Heater coils & insulation also add to the empty weight of the tank car. Viscous crude

	also requires coiled and insulated cars and special loading and unloading equipment in order to heat the crude in order to enable it to flow. · ***Terminal Location***: The level or frequency of service from the railroad will impact the logistics and ultimate capacity. **Market Reach for Rail** The US PADD I (covering inter alia the Atlantic Seaboard states) and Eastern Canada markets represent over 2 million b/d of crude oil demand. Since the refineries in these markets have limited access to North American crude oil supplies via pipelines, the transport of crude oil by has grown noticeably as midcontinent supplies have increased. In general, East Coast refineries are primarily configured to process light crude oil. However, several refineries, including PBF for its Delaware refinery and the NuStar Energy refinery in New Jersey, have invested in rail unloading capacity specifically for heavy crude oil. US PADD III (which includes the US Gulf Coast) is currently the largest destination market for crude oil by rail. The region comprises the largest most complex refining centre in the world and there are many options to deliver crude oil including pipeline to refineries, pipeline to terminals for waterborne exports or to terminals for ultimate delivery to refineries. There are currently only limited options for offloading of heavy crude but capacity is growing and this constraint is expected to ease in the next few years. **Table below shows Crude Oil Specifications and Destination Markets**		

	Light US Crude (Bakken, Eagle Ford, Permian)	Cdn Crude (Light conventional and light synthetic)	Canadian Crude (DilBit)	Canadian Crud RailBit/Raw (U Bitumen
Origin	N. Dakota, Montana, Texas	Alberta or Saskatchewan	Alberta	Alberta
Sulfur Content	<0.5%	>1%	>1%	>1%
Density	6.2 to 7.0 lb/gal	7.2 lb/gal (average)	7.8lb/gal (average)	8.4 lb/gal (avera
Viscosity (cSt at moderate temperature)	<5	5-15	130-220	>250
Destinations	US East Coast (PADD I), Eastern Canada, Western Canada	US East Coast (PADD 1), Eastern Canada, Western Canada	US Gulf Coast (PADD III)	US Gulf Coast (PADD III)
Optimal Car	31,800 gallon 286 GRL Non coiled/Non insulated tank	28,300 or 29,200 gallon	Coiled and insulated	Coiled and insul
Additional Offload infrastructure				Required for raw • steam a • nitrogen • heated s

3.2 Economics of Rail Transport

In general, the opportunity to ship by rail is greatest when the price differential between the market at a point of origin and the market price at the destination exceeds the transportation cost by rail. Recently, this has meant that the economic driver for crude by rail has been between land locked production and coastal markets where higher world oil prices can be accessed.

There are a number of factors which could impact the economics of shipping crude oil to market via rail. These include prices available in various markets that can all be accessed by rail and cost. The type of crude being moved is a key determinant of cost as the heavier the crude oil slate, the more rail cars are required to transport a given volume of crude. Heavy crude is typically transported in steam coiled and insulated cars in order to reduce the viscosity of the crude oil to facilitate the unloading process. The steam line and insulation also adds to the weight of the railcar and therefore limits the amount of the commodity that can be transported before meeting the tank car's weight limitation. In addition, more time is required for loading and unloading heavy crude which thereby adds to cycle times and, in turn increases cost.

A number of uncontrollable factors such as weather or mechanical issues, may also impact cycle times and affect producers' netbacks. The opportunity for diluent backhaul can also be considered when evaluating the costs.

3.3 Market Summary

In the short to medium term, rail can provide the ability to access world oil higher prices if there are constraints in available pipeline capacity. The role of rail will continue to evolve over the longer term with supply characteristics (eg. rail-bit),

	market diversity and the development of the oil transportation system overall, particularly the capacity and timing of pipeline infrastructure. Rail provides Canadian crude oil producers the flexibility to reach a number of key markets throughout North America. Several refinery owners are building unloading facilities to complement rail transportation from the supply regions. Capacity for unloading heavy crude oil, which requires some additional equipment, is growing but large scale facilities that would provide economies of scale are not yet available.		

SET II

Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2019

Course: Economics of Oil and Gas Sector **Semester: IV**

Programme: BA LLB. (HONS.) ENERGY LAWS 2017 - Batch I & II **CC: CLNL 2013**

Time: 03 hrs. **Max. Marks: 100**

Instructions:

SECTION A			
S. No.		**Marks**	**CO**
Q 1	**Write short notes on the following:** 1. Well fluid 2. Gathering pipelines 3. Naphtha 4. Anticlines 5. Wild cat wells 6. Components of LPG 7. API Gravity 8. Geophysical Survey 9. Produced water treatment 10. EOR	**10**	**CO 1**
	SECTION B		
Q 1.	Oil undergoes the three phase separators and is finally dehydrated in the Heater Treater. Explain the process of Heater Treater with the help of a diagram?	**5**	**CO 1**
Q 2.	Compare and contrast between the three major benchmarks of the crude oil?	**5**	**CO 1**
Q 3.	Explain the components of the FDI policy in the Indian Oil and Gas sector	**5**	**CO 2**
Q 4.	Explain the role of GAIL in the City gas distribution	**5**	**CO 2**
	SECTION-C		
Q 1.	If the results of an exploratory drill indicate the possibility of commercially viable oil or gas find then a field development plan is created. Explain the various components of field development plan?	**10**	**CO 2**
Q 2.	Explain the reasons why crude oil prices are rising? How rising crude oil price affects India's GDP growth, inflation, and current account deficit.	**10**	**CO 3**

SECTION-D			
Q1.	During the late 1940's until the early 1960's, the Japanese economy was heavily reliant on the production of domestic coal as its main source of energy. However, during the 1950's as the world price of petroleum was significantly declining petroleum became the main energy source in Japan. By 1962 the use of petroleum as the primary energy source exceeded that of domestic coal. In 1967, the Advisory Council for Energy began pursuing long term energy goals, one of which was the decrease in sulphur content of heavy oil to 1.7% by 1969 and the stabilization of petroleum supplies. Environmental quality was apparently of concern in Japan long before it became a global concern. This is supported by the Air Pollution Regulation Law (1962) and the Basic Law for Pollution Control (1967). These laws were stimulated by the deterioration of environmental quality due to policies to generate high economic growth during the post war period of 1945 to the late 1950's. This economic growth was coupled with severe industrial pollution which was found to be the cause of serious health problems. In order to curb the health deterioration associated with industrial pollution, the Basic Law established environmental quality standards and introduced pollution prevention measures for highly industrialized areas. Due to the "economic harmony" clause in the Basic Law that stated some form of economic development associated with environmental protection, the law was hardly enforced due to ambiguities in which should take precedence. This led to the reformation of the Law in 1970 which defined the pollution standards in Japan. To stimulate the acceptance of these laws by the industrial sector, various forms of fiscal measures were taken. These included low interest government loans, preferential tax treatment and special depreciating schemes for the industrial sector. These measures stimulated massive investments by the industrial sector in technological innovation in order to meet the environmental standards set forth in the revised Basic Law of 1970.	**30**	**CO 3**

	Investments in desulphurization equipment did yield a decrease in SOx emissions, but Japan, like the rest of the world, felt the effects of the 1973 oil shock. This would not have been hazardous to the Japanese economy had it's petroleum demand not accounted for 80% of the total energy demand in Japan. This forced regulators to take action to try to diminish the reliance on petroleum products and its consumption. In 1975, the Advisory Committee for Energy outlined four guides to insure energy security: (1) to reduce the dependency on petroleum by finding alternative energy sources and diversifying its energy sources, (2) to stabilize the petroleum supply, (3) to promote energy conservation, and (4) to facilitate the research and development of new energy sources, stressing the stabilization of petroleum supplies and the conservation of energy. In 1979, the Energy Conservation Law established standards for all energy consuming sectors and called for the increase in energy efficiency in consumer products. These long range goals for economic development and environmental protection through the reduced dependency on petroleum and emissions standards coincided with the second oil crisis of 1979. Although this oil shock affected petroleum prices more than did the first, it hindered the Japanese economy less. Actions taken by regulators had curtailed the dependency and consumption of oil through the diversification of energy and the implementation of fiscal reform and strict enforcement of environmental policies. 1. Explain the turn of events that changed the economic scenario in favor of reduced oil dependence in Japan. (15) 2. Explain the association of Law and how it affected and played a role in conservation of environment, all through. (15)		

Q2	The main objective of NELP was to attract significant risk capital from Indian and Foreign companies, state of part technologies, new geological concepts and best management practices to explore oil and gas resources in the country to meet rising demands of oil and gas. Analyse the journey of offering exploration blocks from NELP to OALP	**20**	**CO 2**