Roll No. _____

University of Petroleum Energy Studies
End - Semester Examination, May 2019

Course : Energy Retail Economics **Semester: IV**
Program : BBA (OG) **Time: 3 hrs**
Course Code : OGOG2003 **MM: 100**

This paper has three sections.

SECTION – A

Each question carries 10 marks(attempt any 4 questions) **Max Marks – 40**

A.1. Differentiate the conceptual process of Thermal vs Gas based Power Plant.

CO2; MARKS:10

A.2. Fill in the blanks of below mentioned some typical efficiency of energy converters

CO3; MARKS:10

Converter	form of input energy	form of output energy	efficiency %
petrol engine	chemical	mechanical	
diesel engine	chemical	mechanical	
electric motor	electrical	mechanical	
boiler & turbine	thermal	mechanical	
hydraulic pump	mechanical	potential	
hydro turbine	potential	mechanical	
hydro turbine	kinetic	mechanical	
Generator	mechanical	electrical	
Battery	chemical	electrical	
solar cell	radiation	electrical	

.

A.3. It was said that two teaspoons of diesel oil are equivalent to the work done by a man in a day. Assume that the power which can be delivered by a man in a day's work is 60 W and that he can do that for 4 hours per day. Can this concept be correct?

CO1; MARKS:10

A.4. A consumer in a town center is charged Rs 0.75 per kWh for his electricity from the national grid. In a rural area, a consumer has a lamp connected to the local micro hydro unit at a cost of Rs 1 per day. Which consumer pays more for his electricity? Assume that the lamp in the village consumes a power of 40 W and Chat It is switched on for an average of 4 hours per day. CO2; MARKS:10

A.5. Critically evaluate and compare the power from oxen with the energy from wood?

CO3; MARKS:10

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SECTION- B

Each question carries 10 marks (Answer any Three). **Max Marks – 30**

B.1. In terms of Indian perspectives define SCARCITY of Energy Sector.

CO2; MARKS:10

B.2. Evaluate the Risks in Energy Trading with five examples.

CO2; MARKS:10

B.3. Match the followings: CO1; MARKS:10

PREFIX	MULTIPLIER
1. giga G	a. 10^{-1} (= a tenth)
2. tera T	b. 10^{6} (= million)
3. mega M	c. 10^{1} (= ten)
4. deca da	d. 10^{9} (= 1,000,000,000)
5. deci d	e. 10^{12}

B.4. For a coal-fired utility boiler, the temperature of high pressure steam would be about 540°C and T cold, the cooling tower water temperature would be about 20°C. Calculate the Carnot efficiency of the power plant? CO2; MARKS:10

SECTION- C (Case Study)

Each question carries 10 marks. **Max Marks – 30**

Inadequate last mile connectivity is the main problem to supply electricity for all users. The country already has adequate generation and transmission capacity to meet the full demand temporally and spatially. However, due to lack of last-mile link-up with all electricity consumers and reliable power supply (to exceed 99%) many consumers depend on DG sets using costly diesel oil for meeting unavoidable power requirements. Also more than 10 million households are using battery storage UPS as back-up in case of load shedding. India imports nearly US$2 billion worth of battery storage UPS every year. The distribution companies should focus on providing uninterrupted power supply to all the consumers who are using costly DG set's power. This should be achieved by laying separate buried power cables (not to be effected by rain and winds) for emergency power supply in addition to the normal supply lines. Emergency supply power line shall supply power when the normal power supply line is not working. Emergency power supply would be charged at higher price without any subsidy but less than the generation cost from diesel oil. Nearly 80 billion KWh electricity is generated annually in India by DG sets which are consuming nearly 15 million tons of diesel oil. Demand build up measures can be initiated to consume the cheaper electricity (average price Rs 2.5 per kWhr) available from the grid instead of running the coal/gas/oil fired captive power plants in various electricity intensive industries. The captive power generation capacity by coal/gas/oil fired plants is nearly 47,000 MW mainly established in steel, fertilizer, aluminum, cement, etc. industries. These bulk captive electricity producers can draw cheaper electricity from the grid on short term open access (STOA) basis and avoid the costly imported coal/RLNG/natural gas or utilize these fuels for process purposes instead of electricity generation. Some of these idling captive power plants can be used for grid reserve service for earning extra revenue. At present substantial diesel oil is consumed by railways for rail traffic on its non-electrified rail lines. To eliminate the substantial cost of imported diesel fuel, power ministry is envisaging funding the electrification of these lines and achieving additional power demand of 7 billion units. No access to electricity: Over 300 million people in India or 60 million households have any access to electricity. Of those who do, almost all find electricity supply intermittent and unreliable. However, many of the power stations are idling for lack of electricity demand. The idling generation capacity can supply three times the domestic electricity needs (nearly 80 billion KWh) of the people who do not have access to electricity. A system of cross-subsidization is practiced based on the principle of 'the consumer's ability to pay. In general, the industrial and commercial consumers subsidize the domestic and agricultural consumers. Further, Government giveaways such as free electricity for farmers, partly to curry political favor, have depleted the cash reserves of state-run electricity-distribution system and led them to amassing a debt of ₹2.5 trillion (US$37 billion). This has financially crippled the distribution network, and its ability to pay for purchasing power to meet the demand in the absence of subsidy reimbursement from state governments. This situation has been worsened by state government departments that do not pay their electricity bills. Name plate/declared capacity of the many coal fired plants owned by IPPs are overrated above the actual maximum continuous rating (MCR) capacity. The reason for overrating the capacity is to over-invoice the plant cost. These plants operate 15 to 10% below their declared capacity on daily basis and operate rarely at declared capacity. Thus these units are not effectively contributing to the on line spinning reserves to maintain power system / grid stabilization. This is also due to reason that point of connection charges are levied in India based on energy exported instead of MCR capacity as applicable for national grid in UK. Intraday load and demand graphs are not made in India at every 15 minutes or less intervals to understand power grid nature and its short comings with respect to grid frequency. These graphs should be plotted with comprehensive data collected from SCADA / on line for all grids connected generating stations (≥ 100 KW) and load data from all substations to impart authenticity to the data presented. Comprehensive list of grid connected power stations along with declared capacity shall be prepared by CEA/POSOCO for all types of power plants (including wind, solar, biomass, co-generation, etc.) and update the data on weekly basis. Coal supply: Despite abundant

reserves of coal, the country isn't producing enough to feed its power plants. India's monopoly coal producer, state-controlled Coal India, is constrained by primitive mining techniques and is rife with theft and corruption. Poor coal transport infrastructure has worsened these problems. To expand its coal production capacity, Coal India needs to mine new deposits. However, most of India's coal lies under protected forests or designated tribal lands. Any mining activity or land acquisition for infrastructure in these coal-rich areas of India has been rife with political demonstrations, social activism and public interest litigations. By the end of year 2015, the international coal prices have dropped to US$42.55 per ton which is below the local coal producer's sale price. This situation is transforming coastal power station's generation cheaper than pit head power station's generation when electricity is made available to major load centers. Being massive consumer of local and imported coal, India should end the Coal India's coal pricing monopoly and implement coal trading in commodities stock exchange to arrive at market determined coal price on daily basis. This is possible by devising standard coal grades / trading instruments and identifying coal supply hubs in central India, eastern India, west coast and east coast to facilitate trading in imported and local coal. Poor pipeline connectivity and infrastructure to harness India's abundant coal bed methane and natural gas potential. The giant new offshore natural gas field has delivered far less gas than claimed causing shortage of natural gas. Average transmission, distribution and consumer-level losses exceeding 30% which includes auxiliary power consumption of thermal power stations, fictitious electricity generation by wind generators & independent power producers (IPPs), etc. The residential building sector is one of the largest consumers of electricity in India. Continuous urbanization and the growth of population result in increasing power consumption in buildings. Thus, while experts express the huge potential for energy conservation in this sector, the belief still predominates among stakeholders that energy-efficient buildings are more expensive than conventional buildings, which adversely affects the "greening" of the building sector. Key implementation challenges for India's electricity sector include new project management and execution, ensuring availability of fuel quantities and qualities, lack of initiative to develop large coal and natural gas resources available in India, land acquisition, environmental clearances at state and central government level, and training of skilled manpower to prevent talent shortages for operating latest technology plants. Hydroelectric power projects in India's mountainous north and north east regions have been slowed down by ecological, environmental and rehabilitation controversies, coupled with public interest litigations. Theft of power: In India, financial loss due to theft of electricity may be around $16 billion yearly. Populist pro-free power measures also bleed the power companies. Some power companies continue to bleed and lead to bankruptcy due to one of these factors. This also leads to pay more by legal users. This creates a scenario where villages have huge cut of power and simultaneously availability of power in the grid with no purchase by DISCOMs. Losses in the connector systems/service connections leading to premature failure of capital equipment's like transformers. India's nuclear power generation potential has been stymied by political activism since the Fukushima disaster. The track record of executing nuclear power plants is also very poor in India. Lack of clean and reliable energy sources such as electricity is, in part, causing about 800 million people in India to continue using traditional biomass energy sources – namely fuel wood, agricultural waste and livestock dung – for cooking and other domestic needs. Traditional fuel combustion is the primary source of indoor air pollution in India, causes between 300,000 and 400,000 deaths per year and other chronic health issues.

Questions:-

Q1. Please mention the ten problems in Indian power sector which we are facing. CO2; MARKS:10

Q2. How we will deal with these problems and what options we have as solutions for these problems.

CO2; MARKS:10

Q3. Analyze to utilize SCADA to overcome with the problems of Power sector? Define how it will be useful in Indian scenario. CO3; MARKS:10

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SECTION – A

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A.1. Analyze the critical processes with systematic diagram of a Gas based Power Plant.
CO2; MARKS:10

A.2. Compare the ideal coefficients of performance of the same heat pump installed in Mumbai and Bengaluru. CO2; MARKS:10

M: T_{hot} = 70°F, T_{cold} = 40°F

B: T_{hot} = 70°F, T_{cold} = 15°F

M: T_{hot} = 294°K, T_{cold} = 277°K

B: T_{hot} = 294°K, T_{cold} = 263°K

A.3. Concept of comparatives of Economics with elaborate examples. CO1; MARKS:10

A.4. Critically analyze and evaluate Energy Accounting Framework tool what are the main flows considered in Energy accounting.
CO3; MARKS:10

A.5. Fill in the blanks: CO2; MARKS:10

Energy equivalent values of some fuels

Fuel	unit	tonnes of coal equivalent	tonnes of oil equivalent	barrels of oil equivalent	GJ (*)
coal	tonne	1	0.7	……	29.3
firewood (**) (air-dried)	tonne	0.46	0.32	…….	……..
kerosene (jet fuel)	tonne	1.47	……	……	……
natural gas	1000 m^3	1.19	0.83	…….	……..
gasoline	barrel	0.18	0.12	…….	5.2
gasoil/diesel	barrel	0.2	0.14	…….	5.7

(*) Note that GJ/tonne is the same as MJ/kg.

(**) Note that the energy equivalent of wood can vary a factor 3 depending on the moisture content of the wood.

SECTION- B

Each question carries 10 marks (Answer any Three). **Max Marks – 30**

B.1. Analyze the terms of Indian perspectives & define SCARCITY of Energy Sector. CO3; MARKS:10

B.2. Describe the analysis of Hedging related to Risks in Energy Trading with examples. CO3; MARKS:10

B.3. Match the followings: CO1; MARKS:10

STOCK MARKETS	COUNTRY
1. Hang Seng	a. Canada
2. Nikkei	b. Germany
3. Strait Times	c. Switzerland
4. SX 40	d. South Africa
5. NASDAQ	e. Singapore
6. Shenzhen	f. Hong Kong

7. TMX	g. India
8. Deutsche	h. USA
9. SIX	i. China
10. JSE	j. Japan

B.4. For a coal-fired utility boiler, the temperature of high pressure steam would be about 540°C and T cold, the cooling tower water temperature would be about 20°C. Calculate the Carnot efficiency of the power plant? CO2; MARKS:10

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CO2; MARKS:10

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CO3; MARKS:10