**Registration no:** | | | | | | | | | | |

**Total Number of Pages: 02**



**M .TECH**
**P2PICC01**

# 2nd Semester Regular Examination 2016-17

## FOUNDATION FOR ENERGY SYSTEMS TECHNOLOGY

## BRANCH:POWER AND ENERGY ENGG, POWER ENGG AND ENERGY SYSTEMS

## Time: 3 Hours

## Max Marks: 100

## Q.CODE:Z366

**Answer Question No.1 which is compulsory and any four from the rest.**
**The figures in the right hand margin indicate marks.**

Q1 **Answer the following questions**: (2 x 10)

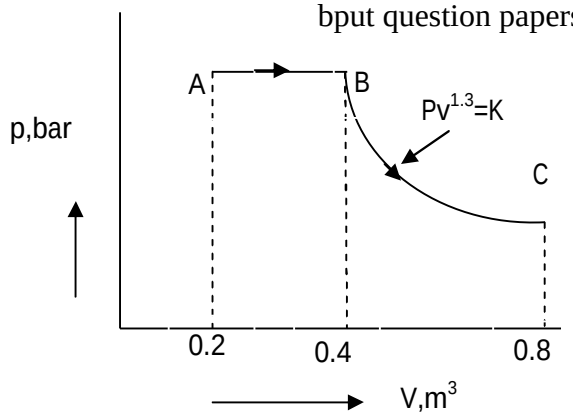
a) State basic principle of Solar Photovoltaic conversion?
b) State second law of thermodynamics.
c) What do you mean by irreversibility? Mention factors of irreversibility.
d) What is heat pipe?
e) Mention the different types of concentrating type solar collectors.
f) Write down different types of nozzles used in injectors for CI engine.
g) What is the effects of intercooling and regeneration on the work output and efficiency of gas turbine?
h) Draw the p-V and T-s diagram for Bryton cycle.
i) Differentiate between proximate and ultimate analysis in combustion system.
j) Differentiate between flash point and fire point.

Q2 a) Discuss essential feature of steam power plant. (5+5)
Explain with neat sketch, the construction and working of any one type boiler.

b) In a gas turbine plant, operating on Joule cycle, maximum and minimum temperatures are 825°C. The pressure ratio is 4.5. Calculate the specific work output, cycle efficiency and work ratio. Assume isentropic efficiencies of the compressor and turbine at 85 and 90 percent respectively. What is the heat rate in kJ/Kw-hr? If the rating of the turbine is 1300 kW, what is the mass flow in kg/sec? Neglect mass flow. of fuel. Assume cp=1.005kJ/kgK. (10)

Q3 a) Determine the total work done by gas system following an expression process as shown in the following process. (5+5)






What is heat transfer? Mention different modes of heat transfer.

b) Air at -15°C passes through a heat exchanger at a velocity of 30m/s where its temperature is raised to 800°C. It then enters a turbine with a velocity of 30 m/s and expands until the temperature falls to 650°C. On leaving the turbine, air is taken at a velocity of 60 m/s to a nozzle where it expands until the temperature has fallen to 500°C. if the air flow rate is 2 kg/s, calculate (i) the rate of heat transfer to the air in the heat exchanger. (ii) the power output from the turbine assuming no heat loss (iii) the velocity exit from the nozzle, assuming no heat loss. Take the enthalpy of air as $h=c_pt$, where $c_p$ is the specific heat equal to 1005J/kgK and t is the temperature. (10)

Q4 a) Water flowing in a pipe of 250 mm diameter at a rate of 0.4m3/s enters suddenly into a pipe of 500mmdiameter. Determine the loss of head due to sudden enlargement. (7+7)

In a sudden enlargement of water main from 250 mm diameter to 500 mm diameter, the hydraulic gradient rises by 15 mm. Estimate the rate of flow.

b) Differentiate between major and monor losses in pipe flow. (6)

Q5 a) A liquid (Cp=0.8 kJ/kg K) is entering a counter flow heat exchanger at $25^0$C at a rate of 2.5 kg/s. It is heated to $750^0$C by another fluid (Cp=1 kJ/kg K) with a flow rate of 2 kg/s entering at $1000^0$C. With these things remaining same, what will be percentage change in the area of heat exchanger if the fluid is heated up to $600^0$C instead of $750^0$C? (13)

b) Differentiate between parallel flow, counter flow and cross flow heat exchangers. (7)

Q6 a) In an oil fired boiler the fuel had an analysis by mass: carbon 84%, hydrogen 10%,suplhur 3.2%,oxygen 1.6%, remainder incombustible. The analysis of dry flue gas by volume gave: combined $CO_2$+$SO_2$ 15.72%, $O_2$ 1%, there being no CO or $SO_3$. Calculate per kg of fuel (i) mass of air supplied (ii) percentage of excess air supplied (iii) mass of dry flue gas formed (iv) mass of water vapor formed. (13)

b Explain in detail the structure of a flame, the temperature profile and the concentration profile of a flame (7)

Q7 **Write short notes on (any four)** (5×4)

a) Biomass Energy Conversion b) Wind Energy Conversion
c) Ocean Thermal Conversion d) Refrigeator and Heat Pump
e) Energy from waste