Diploma Mechanical Fifth Semester
Power plant Engineering

Rev 15
5023

Part - A

I
1) a) chemical reaction in which carbon combines with O_2 to produce large amount of heat 1+1

b) Minimum qty of air supplied maximum O_2 for complete combustion of fuel. 1+1

2) HCV → combustion products are allowed to condense and that heat is also taken into account 1+

LCV → combustion product not allowed to condense and that heat not taken in account 1

3) condenser efficiency : ratio of actual rise in temp of cooling water to max possible rise used in cooling water 1

vacoom efficiency : ratio of partial pressure of steam corresponding to condensate temp to absolute pressure in condenser 1

4) pressure
velocity and
pressure velocity } compounding 2

5) U, Th

Part - B

II

1) a) the temp at which vapour fuel mixture just sufficient to ignite it momentarily is flash point

b) temp at which vapour fuel mixture sufficient to ignite for at least 3-5 seconds.

c) The temp at which work canes out To handle the fuel with out any danger during transportation.

2) 1) High calorific value 4) less pollution
2) low moisture content 5) economical
3) low emission 6) easy to store & handle

3) in jet condenser the exhaust steam & cooling water are mixed with each other

— In surface condenser the exhaust and cooling H_2O do not mix with each other

4) gas Turbine: main elements compressor, combustion chamber of heating chamber, gas Turbine and cooling chamber.

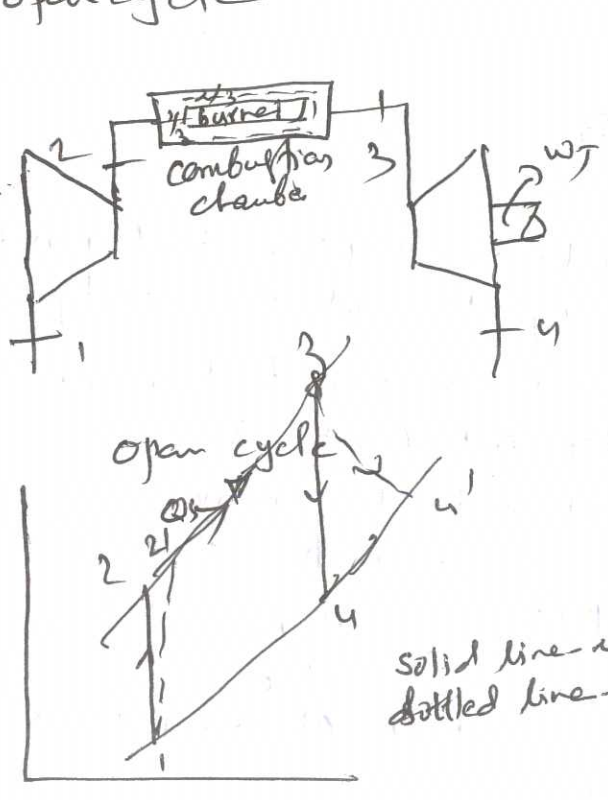
working with Brayton cycle
two constant pressure process and
two isentropic process

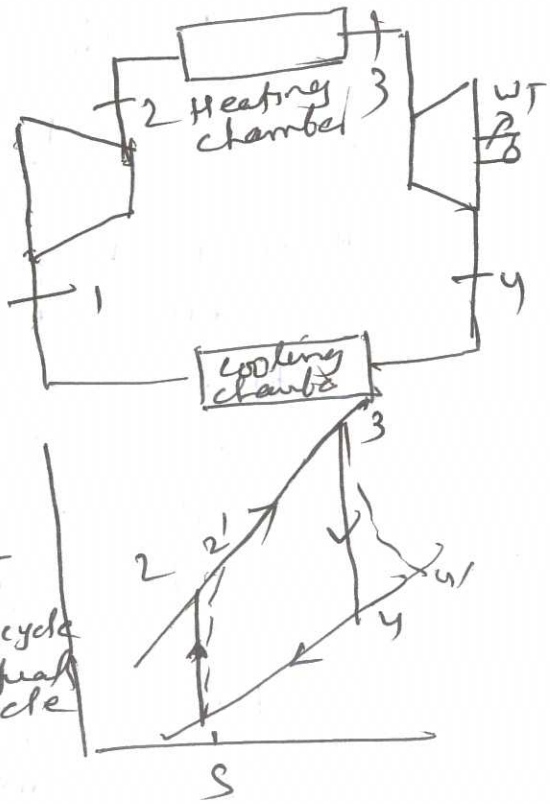
Steam Turbine: main components are steam generator / boiler, steam Turbine, condenser and pump

working with Rankine cycle

two constant pressure and isentropic expansion and isentropic / constant volume pump work,

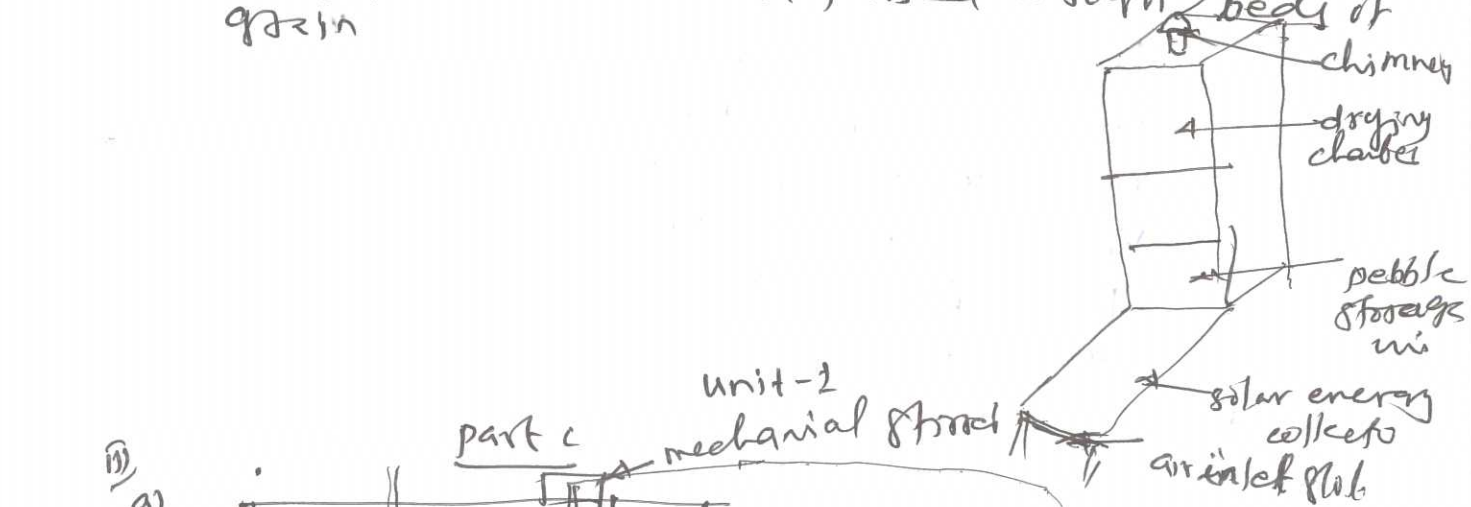
5) open cycle and closed cycle





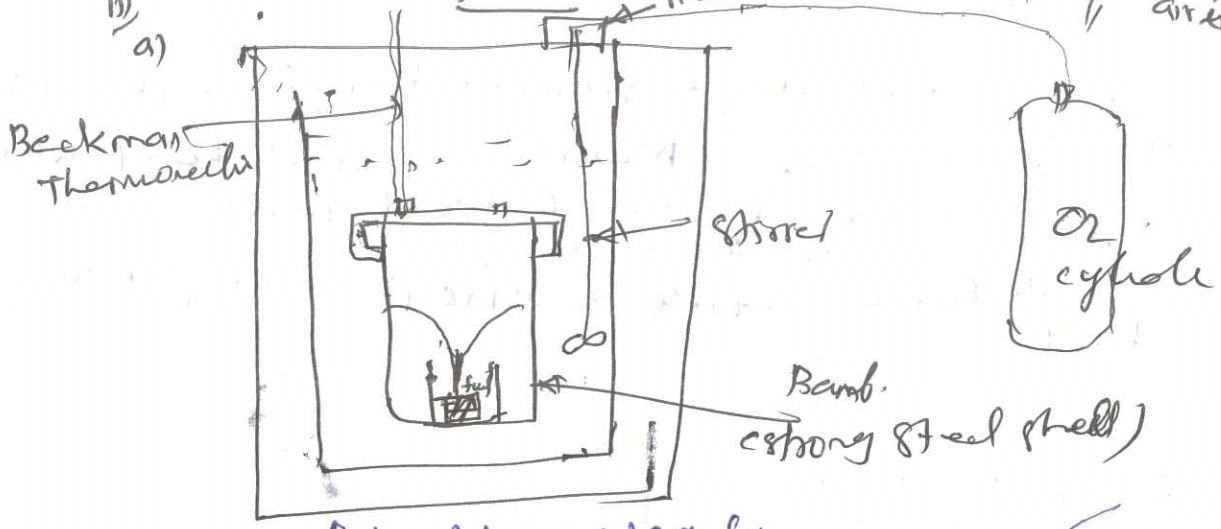
6) Six types of reactors
PWR, BWR, CANDU, RBMK, magnox
AGR) using to produce commercial electricity.

7) An improved technology in utilising solar energy for drying grain. In solar dryers air is heated in solar collectors and passed through bed of grain



part c

iii) a)

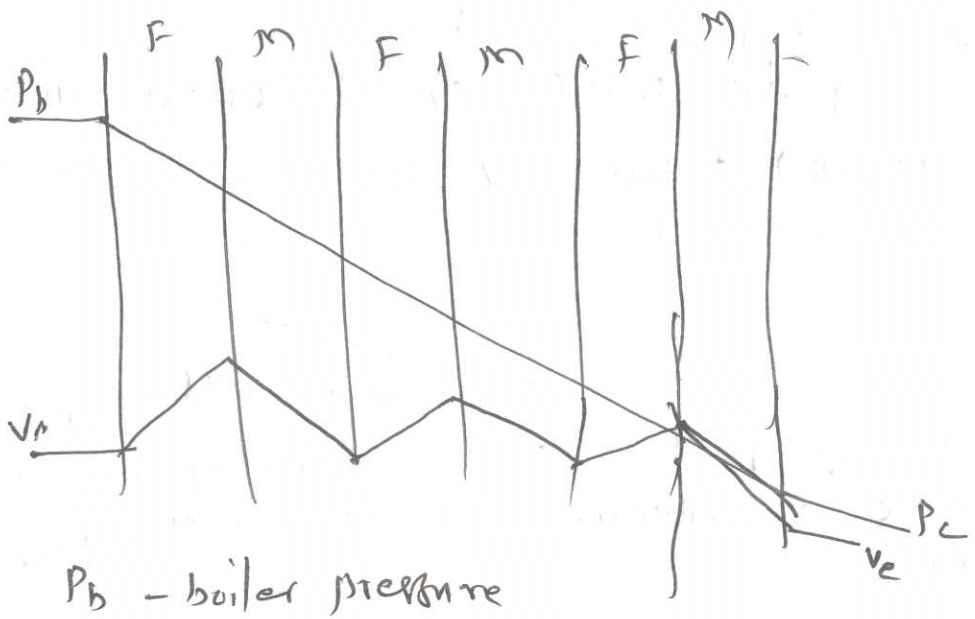


$(W+w)t = w_f \times C_V$

$C_V = \frac{(W+w)\Delta T}{w_f}$

b) Energy available at inlet of turbine is partially K.E and partially pressure energy. The pressure energy goes on decreasing while steam passes through fixed and moving blades.

eg: Parson's reaction Turbine



P_b – boiler pressure
P_c – condensing pressure
V_r – resultant velocity
V_e – exit velocity
F – fixed blade
M – moving blade

OR

IV

a) Time :- fuel stay for sufficient time for complete combustion
Temperature :- Maximum correct temp which entire fuel is burned quickly
Turbulence :- 3T factors ;-
Turbulence ensures a thorough mixing of air & fuel.

b) $C = 86.1\% = 0.861$
$H_2 = 3.9\% = 0.039$
$O_2 = 1.4\% = 0.014$
$ash = 8.6\% = 0.086$

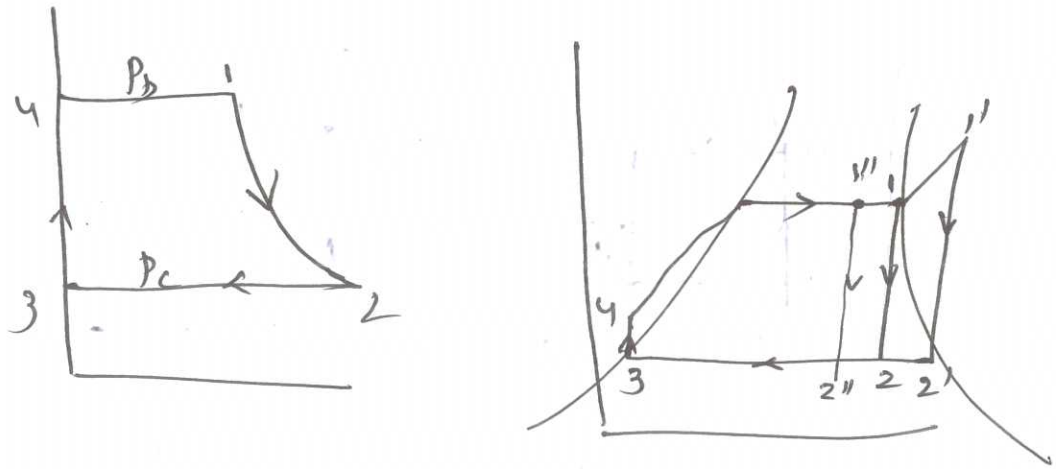
theoretical or minimum air required for combustion of fuel.

$$\frac{100}{23}\left[\frac{8}{3}C + 8H_2 + S\right]$$

$$\frac{100}{23}\left[\frac{8}{3} \times 0.86 + 8 \times 0.039 + 0\right] \text{ kg}$$

V>

a)



1-2 isentropic Expansion:

Turbine work $W_T = h_1 - h_2$

2-3 constant pressure heat rejection

3-4 - isentropic / constant volume pump work

$$h_{f4} - h_{f3} = v_{f3}(P_b - P_c) \times 100$$

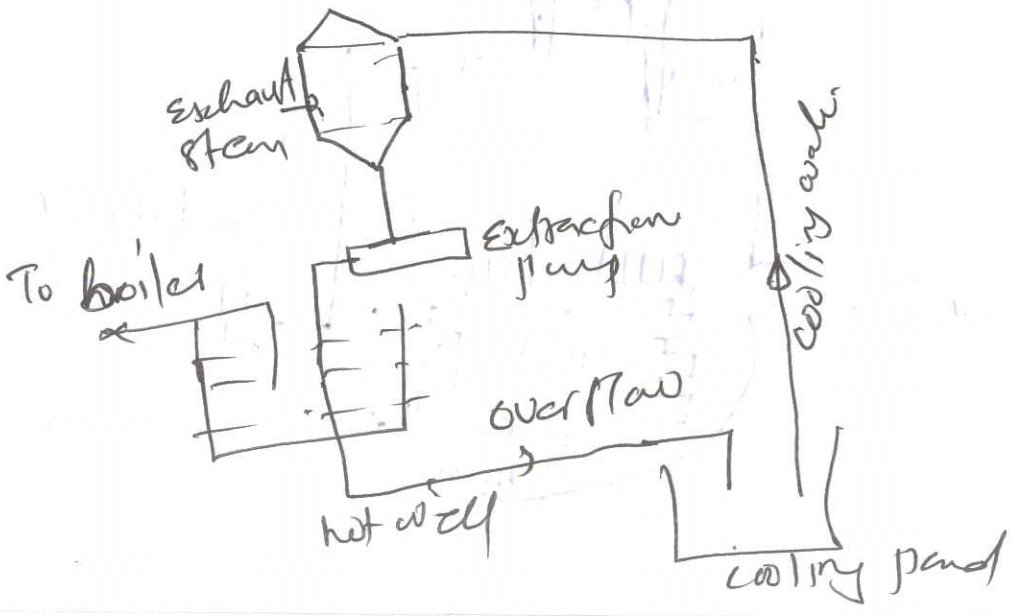
4-1 constant pressure heat supplied

$$Q_s = h_1 - h_{f4}$$

$$\eta_{Rankine} = \frac{\text{Net workdone}}{\text{Heat supplied}} = \frac{W_{Turbine} - W_{pump}}{Q_{supplied}}$$

$$= \frac{(h_1 - h_2) - v_{f3}(P_b - P_c) \times 100}{(h_1 - h_{f4})} \times 100$$

b) low level or high level condenser



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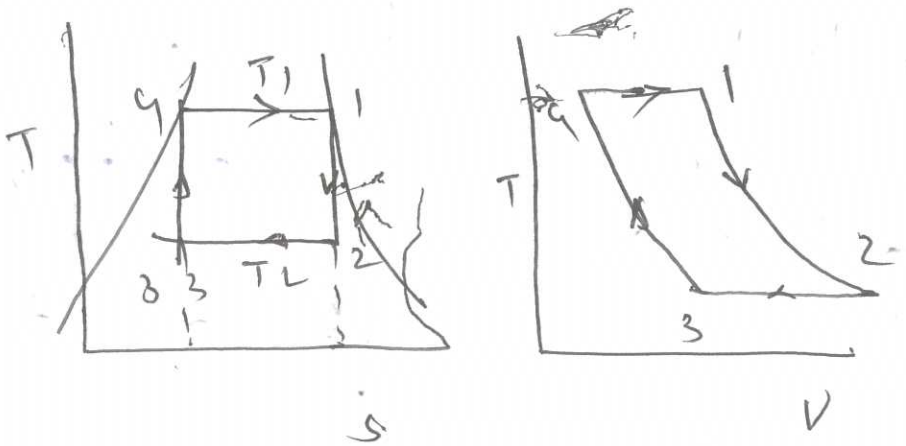
VI

a)



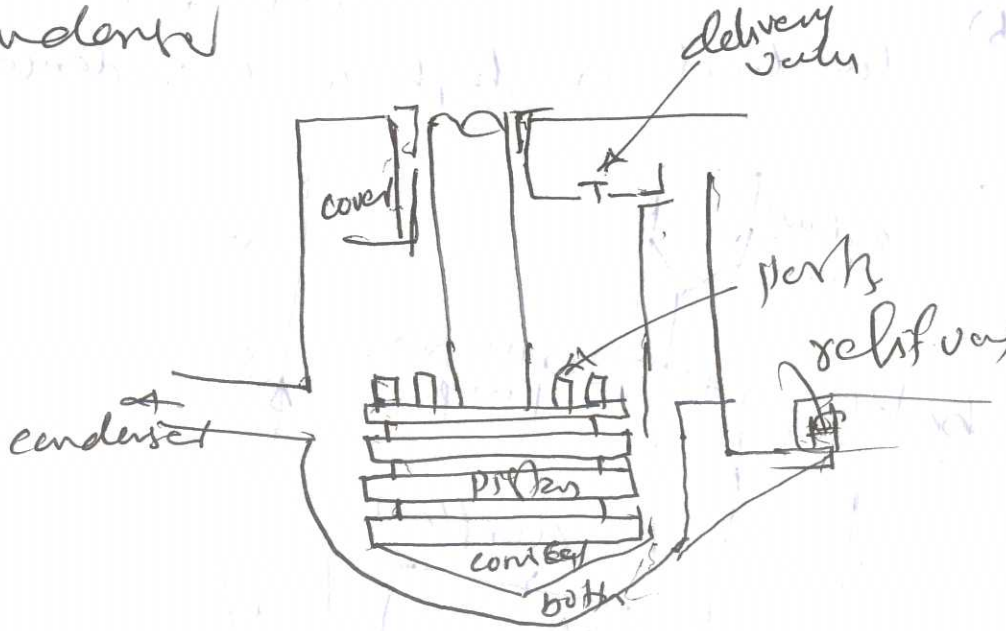
4 - heat absorption at constant temp T_1

1 - 2 steam isentropically expand

2 - 3 heat rejected at constant pressure

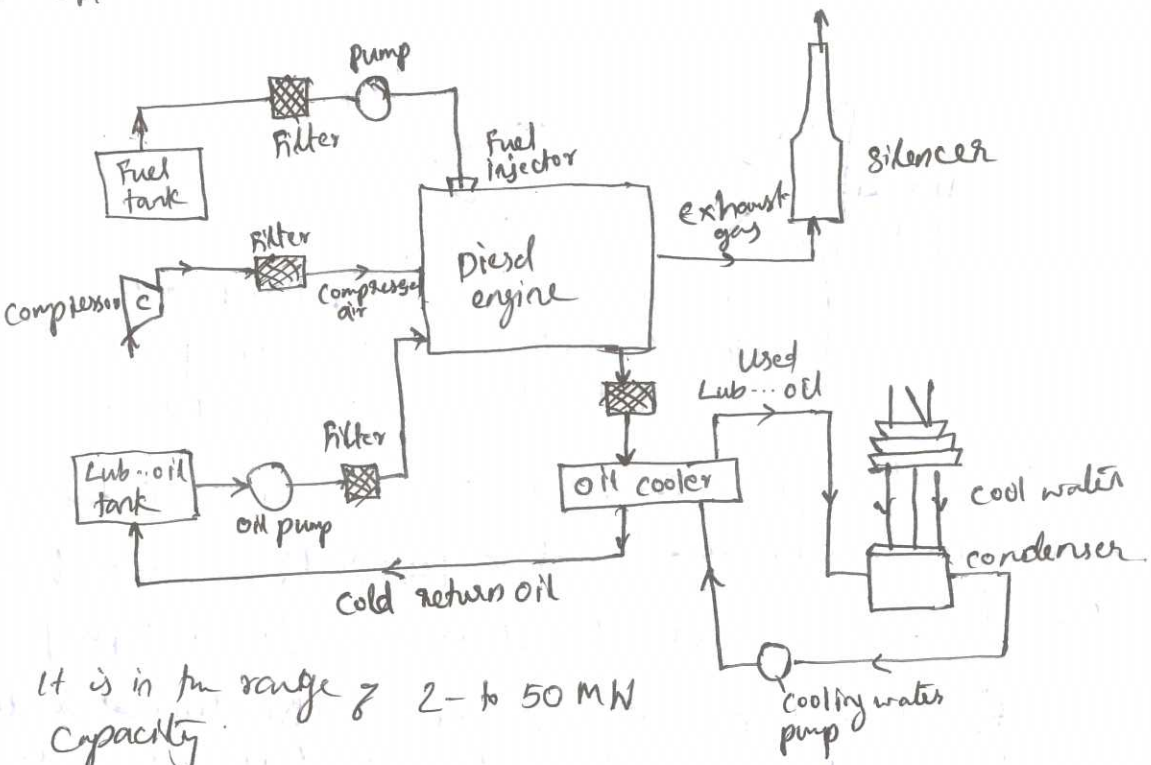
3 - 4 ~~steam~~ wet ~~steam~~ steam compressed isentropically

b) used to remove condensate air from the condenser : Air pump creates vacuum in condenser corresponding to exhaust steam temp. both air and condensate ~~from~~ remove from condenser



VII

a)



- It is in the range of 2- to 50 MW capacity.

Diesel engine will provide the most economic means of generating electricity on small scale particularly where there is no convenient site for micro-hydro plants.

b). Application :

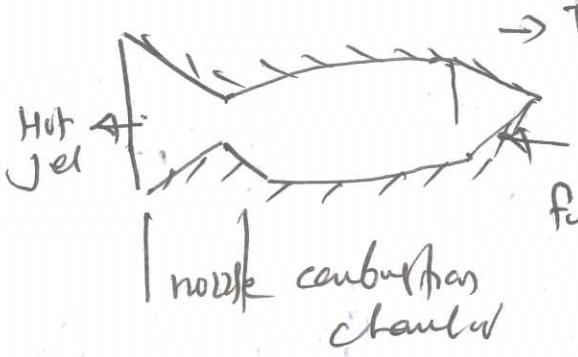
- Used for peak load service
- Fully automatic booster stations at the end of transmission lines.
- In countries where oil or natural gas are cheap and easily available
- Bombproof power plants.

Limitations :

- High specific fuel consumption.
- It is not readily reversible
- Starting of plant is not a simple
- Unit capacity is limited.
- Overall efficiency is very low.

VIII

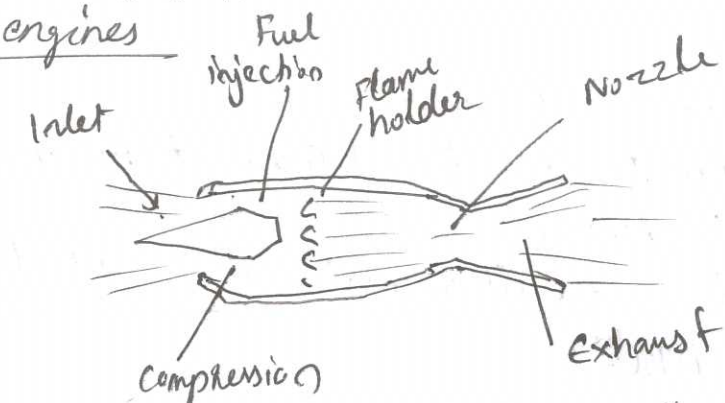
a)



rocket engine consist of a container for propellant, combustion chamber and a propulsion or exhaust nozzle and control and navigational equipment.

fuel and oxidiser are introduced into combustion chamber for chemical reaction. The product of combustion expand through propelling nozzle with very high velocity. This gives high value of thrust.

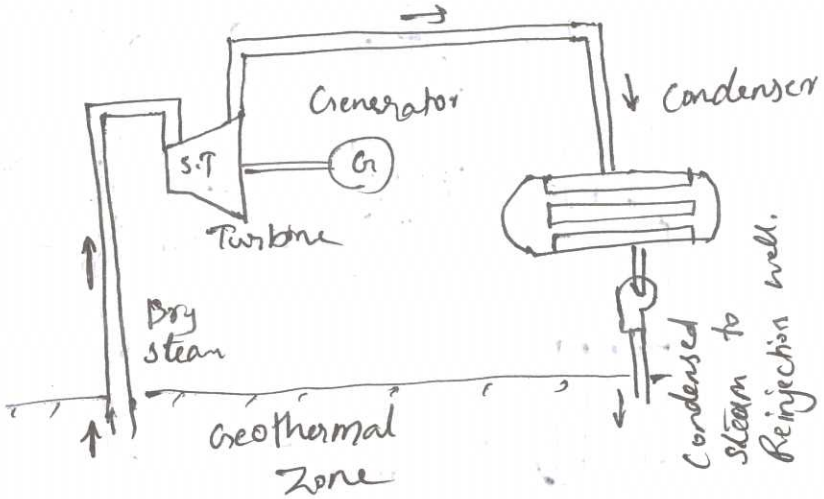
b) · Ramjet engines



It is a form of airbreathing jet engine that uses the engines forward motion to compress incoming air without an axial compressor or a centrifugal compressor. A ramjet powered vehicle requires an assisted take off like a rocket assist to accelerate it to a speed where it begins to produce thrust. Ramjets employ a continuous combustion process.

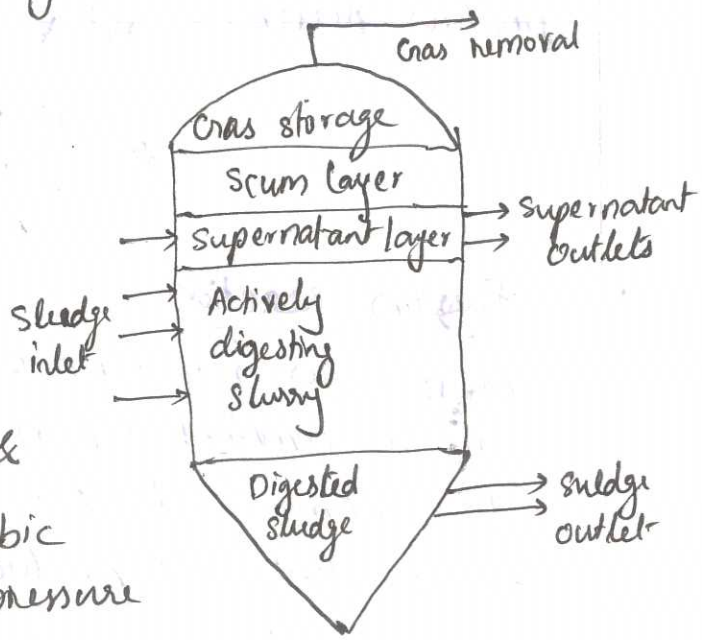
Unit IV

IX a) Geo Thermal power plant-



- 1500 mw of power is being generated in the world from geothermal source.
- Four types :
  1. Dry steam systems.
  2. Wet steam systems.
  3. Hot dry rock systems.
  4. Magmatic (molten rock) - chamber system.

b) Bio gas plant with diagram

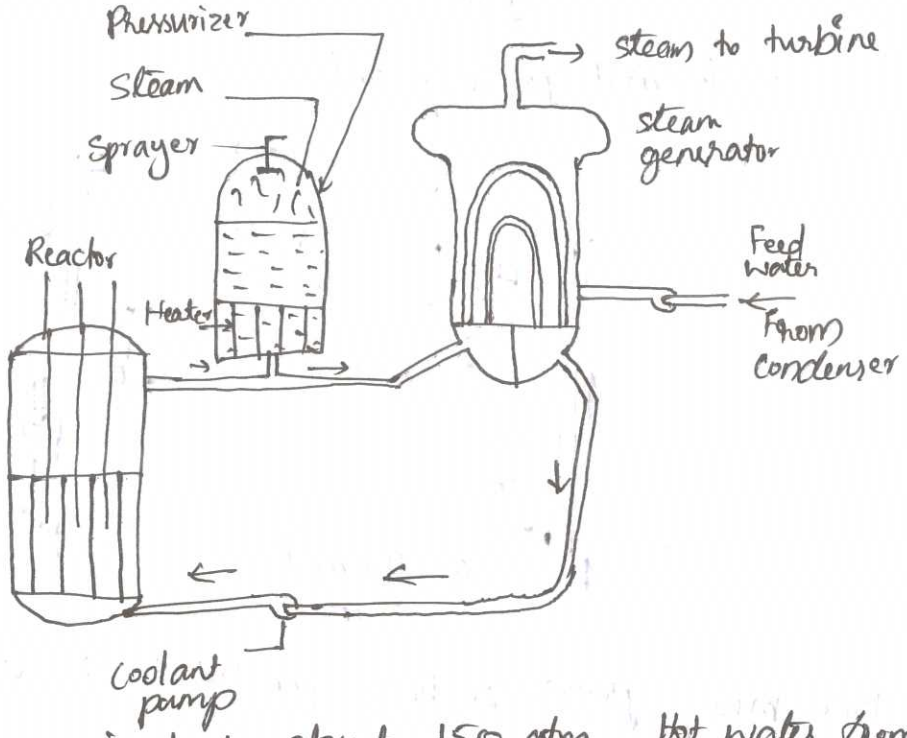


Bio gas is produced by digestion, pyrolysis or hydro-gasification.

Digestion is a biological process that takes place in the absence of oxygen & in the presence of anaerobic organisms at ambient pressure and temperature.

Bio gas consists of 55-65 % methane, 30-40 % CO_2 and others impurities as H_2, H_2S & N_2 and produced from the decomposition of animal, plant waste.

X a) PWR power plant

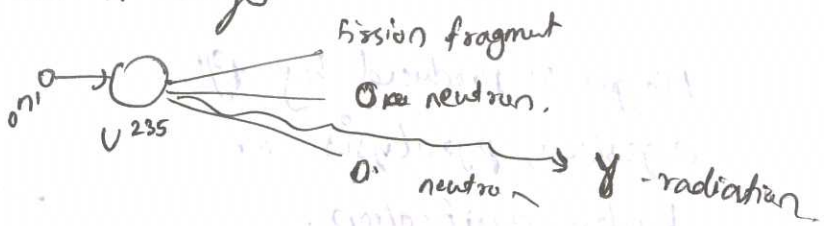


water is pressurized to about 150 atm. Hot water from the reactor flows to a heat exchanger where its heat is transferred to the feed water to generate steam. secondary cooling circuits operates at a lower pressure

b)

Fission Reaction

It is the process in which heavy nucleus is split when it is bombarded by certain particles. bombarding particles such as protons, neutrons and x-rays.



Fusion Reaction

Nuclear fusion is a reaction in which two or more atomic nuclei are combined to form one or more different atomic nuclei and subatomic particles. The difference in mass between the reactants and products is manifested as either the release or absorption of energy