* Power Plant *

Gate 4 to 5 Marks
70

ESE (40-50 / 200) up-to last year

Conv. = (60 to 70 / 280)

- Gas Turbine
- Air compressor
  - Reciprocating
  - Centrifugal
  - Axial
- Rankine or vapour power cycle.
- Thermal Power Plant.
  - Steam turbine
  - Boiler
  - Condenser & Cooling Tower.
- Jet Propulsion.

} Not in Gate. only for ESE

Gas turbine - V. Ganeshan

Power plant engg. - P.K. Nag.

Power plant engg. - R. Yadav.

Thermodynamic cycle (T.C.)

Power

+ve work

Clockwise on P-V/T-s dia

η

Fluid energy ↓

Refrigeration

-ve work

Anticlockwise P-V/T-s dia

COP

Fluid energy ↑

T.C.

⇒ Gas cycle (very defficult to condense)

⇒ Vapour cycle. (easy to condence)

Gas cycle: working substance remain in single Graseous phase throught the cycle

Vapour cycle: working substance remain in liquid phase for the half cycle and in the vapour phase for next half cycle.

Power Plant

Steam turbine → stainless steel, Ti alloy

Gas turbine → Nickel based super alloy

T. C.

- open cycle
- Closed Cycle.

open cycle	Closed Cycle.
- In every cycle fresh working substance is used and exhausted.	- In every cycle the same working substance is again & again re circulated.

	Steam P.P. (60%)	Gas Turbine P.P (10-12%)	I.C. Engine (Generator) P.P. (1-2%)
Cycle	Rankine	Brayton	Diesel or otto
Fuel	Coal, HSD (High speed diese), paraffin oil etc.	Natural Gas, Methane, ethane etc.	Diesel, Petrol Kerosene etc.
Max. Temp.	620°C	1300°C	2500°C
Pressure Ratio	180 - 300	10 - 12	15 - 25
Weight/Power	55 kg/kw	20 kg/kw (used in aircraft)	115 kg/kW
efficiency	35% to 37%	22 to 27%	27% to 32%
Pollution	Highest	least	Medium.
Installation	3 to 4 year / 200 MV	2 to 3 yrs / 200 MV	1 to 9 months / 1-2 MV.