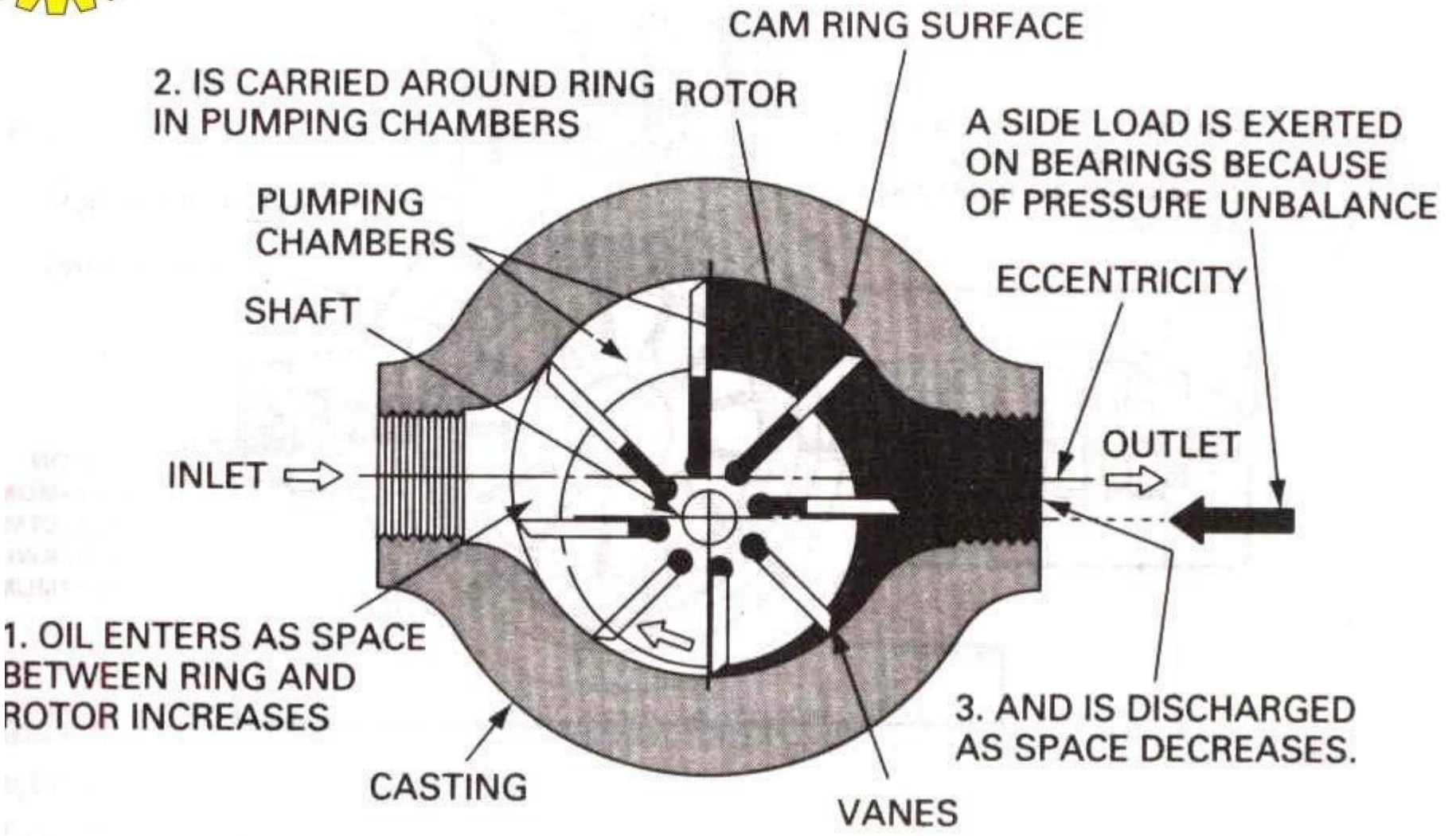
SNS COLLEGE OF TECHNOLOGY, Coimbatore - 641 035
(An Autonomous Institution)
Department of Mechatronics Engineering

# UNIT I- FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS

# VANE PUMPS

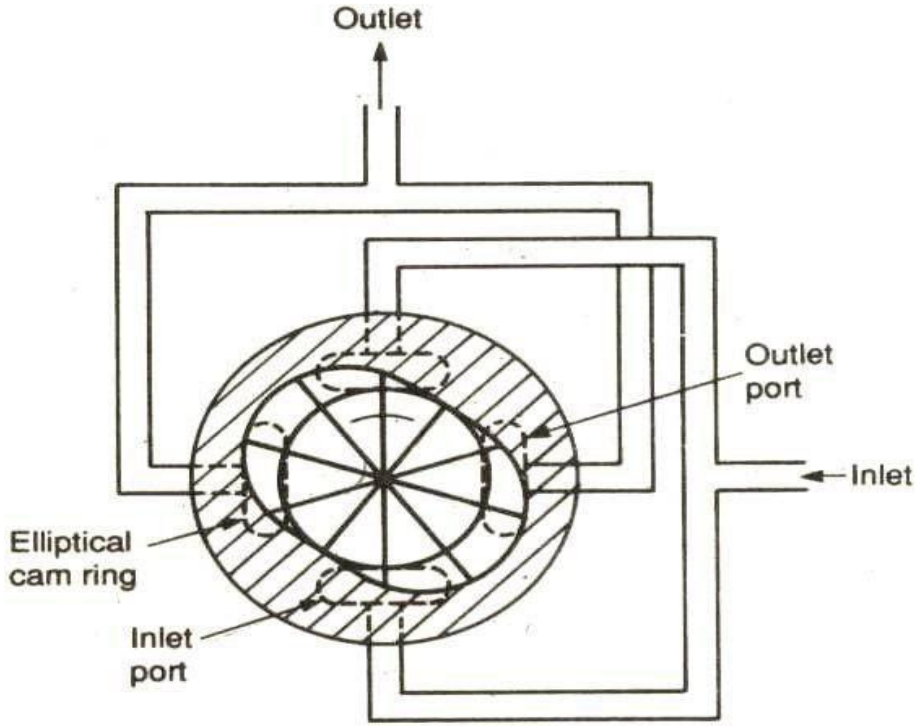

CAM RING SURFACE
2. IS CARRIED AROUND RING IN PUMPING CHAMBERS
ROTOR
A SIDE LOAD IS EXERTED ON BEARINGS BECAUSE OF PRESSURE UNBALANCE
PUMPING CHAMBERS
ECCENTRICITY
SHAFT
OUTLET
INLET
1. OIL ENTERS AS SPACE BETWEEN RING AND ROTOR INCREASES
3. AND IS DISCHARGED AS SPACE DECREASES.
CASTING
VANES

# UNBALANCED VANE PUMP

- Axis of the rotor (splined to drive shaft ) positioned eccentric to the circular cam ring
- Rotor (rotates inside the cam ring) has radial slots containing spring loaded vanes
- Vane mates with the surface of the cam ring due to centrifugal force exerted by rotor
- **1st half revolution of rotor** –increase in volume between rotor & cam ring, **drop in pressure resulting in suction process**
- 2nd half revolution –cam ring pushes vanes back into the slots resulting in discharge
- The discharge & suction side of the pump are sealed from each other at any time by at least one vane (track between two ports is slightly wider than the space between two vanes)

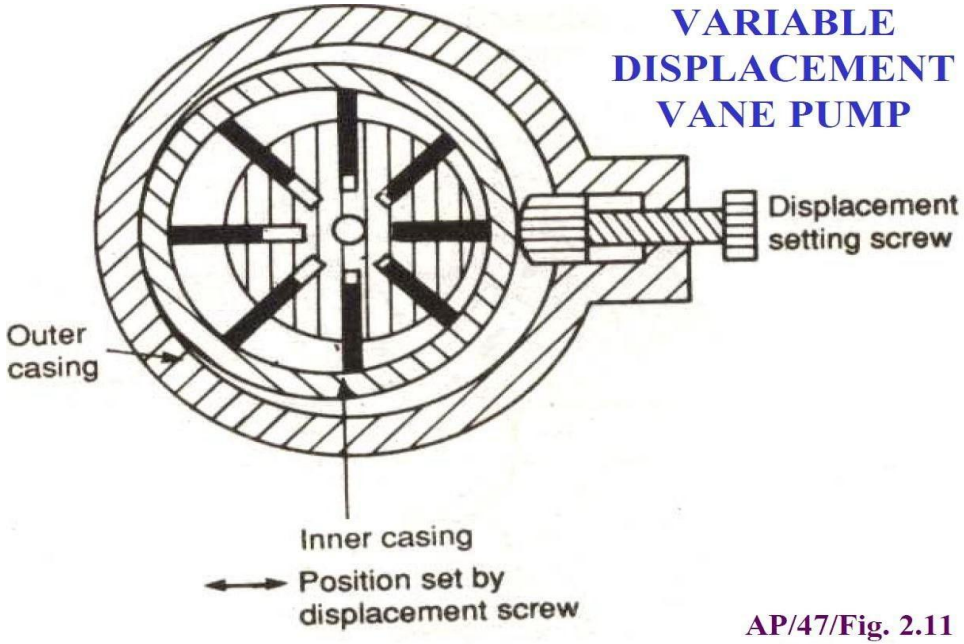
# BALANCED VANE PUMP

- Circular rotor with vane slots concentrically positioned with the axis of an **elliptical cam ring**
- Vanes reciprocates twice during **one revolution** of **rotor giving two pumping actions** per rotor revolution
- Two inlet & two outlet ports are diametrically opposite to each other (pressure ports are opposite leading to zero net force)
- Forces acting on shafts are fully balanced




- In actual design both inlet & outlet ports are connected together
- Intra-vane principle (pressure oil is fed to the underside of the vanein such a manner that maximum force occurs on the vane)
- Fixed displacement type pump which operates up to 175 bar pressure
- Relatively quite & of simple construction
- Can not be designed as variable displacement unit

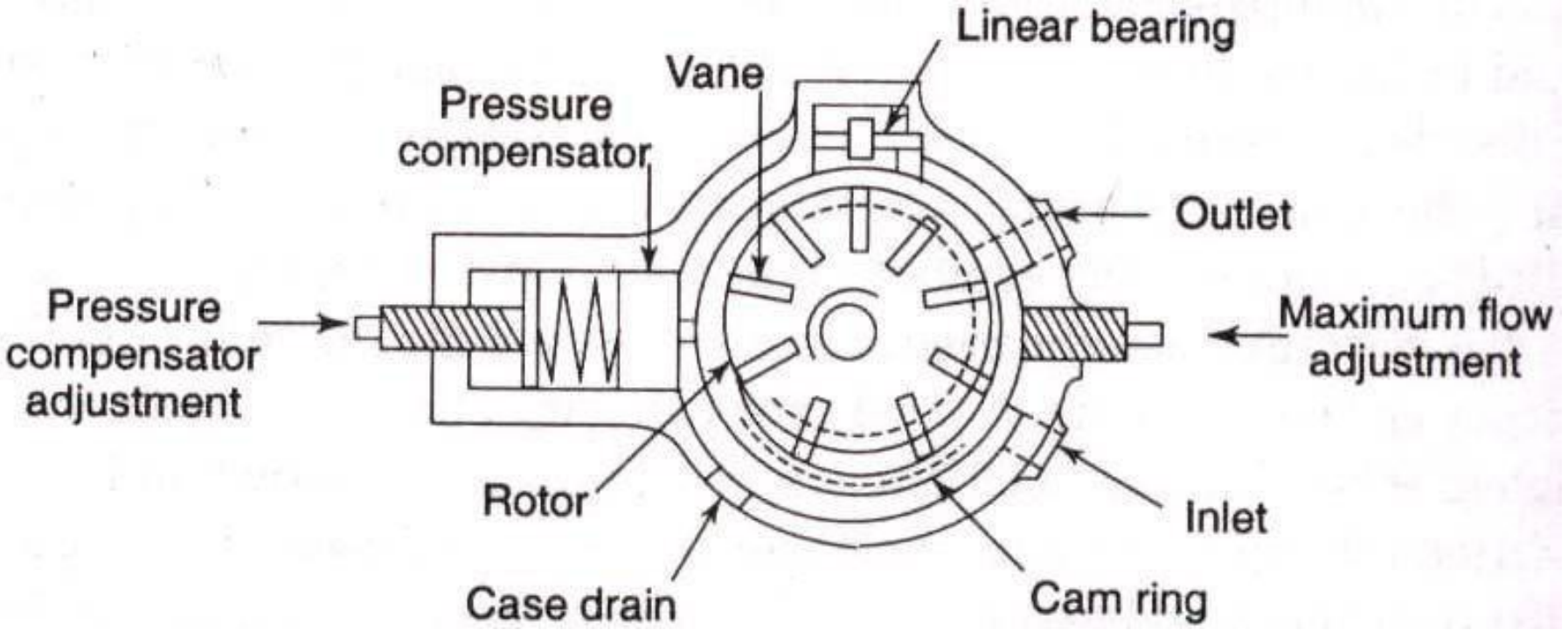
## VARIABLE DISPLACEMENT VANE PUMP



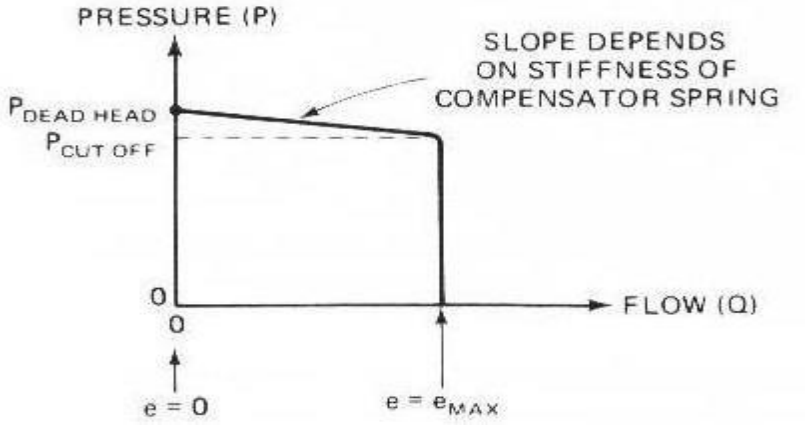

AP/47/Fig. 2.11

- In hydraulic system the flow rate of the pump needs to be variable which can be achieved by varying the rpm of the electric motor
- Varying the pump displacement can be easily effected
- Displacement of the vane inside the pump & therefore its delivery is proportional to the eccentricity between rotor axis and cam ring
- When eccentricity (e) is positive, flow (Q) is maximum
- When ‘e’is zero, ‘Q’is zero
- When ‘e’is negative, the direction of the flow gets reversed

# PRESSURE COMPENSATED VANE PUMP



- In certain hydraulic systems design, it is desired that when the predetermined system pressure is reached, the pump should stop pumping further oil to the system –Pressure compensated vane pump
- Consists of an **additional spring** which is adjusted to offset the **cam ring**
- As the pressure acting on the inner contour of the ring is more than the pressure exerted by the spring, the cam ring becomes concentric to the rotor and pumping action stops




- In some pumps spring is replaced by a piston & pressure control valve
- When system pressure reaches the setting of the control valve, it is applied to the piston centralizing the ring and the rotor, reducing pump displacement to zero

# Advantages of vane pump

- Handles thin liquids at relatively higher pressures
- Compensates for wear through vane extension
- Sometimes preferred for solvents, LPG
- **Develops good vacuum**

# Dis-advantages of vane pump

- Complex housing and many parts
- Not suitable for high pressures
- **Not suitable for high viscosity**