**MODULE-2**

**Evaluation of crude oil properties and design of crude oil distillation column.**

**Q1:** Define Viscosity Index (VI).

**A1:** Viscosity Index (VI): Used to characterize a Lube oil and provides the effect of change of temperature on the viscosity of any oil. High VI lube oils are desired. It is defined by

\[ VI = \frac{(L - U)}{(L - H)} \times 100 \]

U=kinematic viscosity at 40°C of the oil whose VI is to calculated.

L= kinematic viscosity at 40°C of the oil whose 0 VI.

H= kinematic viscosity at 40°C of the oil whose 100VI.

**Q2:** What are different additives, their function and composition?

**A2:**

<table>
<thead>
<tr>
<th>Additive</th>
<th>Function</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-knock compounds</td>
<td>To improve octane quality</td>
<td>Lead alkyls such as tetraethyl lead and tetra methyl lead along with scavengers ethylene dibromide and ethylene dichloride</td>
</tr>
<tr>
<td>Anti-icing additives</td>
<td>To minimize engine stalling</td>
<td>Freezing point depressants such as alcohols(ethanol or iso propanol) and glycols (hexylene glycol and di propylene glycol)</td>
</tr>
<tr>
<td>Anti-oxidants</td>
<td>To minimize gum formation</td>
<td>Phenylene diamine and alkyl</td>
</tr>
</tbody>
</table>
and improve storage stability.

phenol compounds.

| Metal deactivators | To prevent catalysis of oxidation processes by deactivating metal ions such as copper. | N,N-disalicylidene-1,2-propanediamine. |

Q3: What is the composition of kerosene oil?

A3: Kerosines are distillate fraction of crude oil in the boiling range of 150-250°C. There are various types of hydrocarbon present in kerosines like paraffin, naphthenes, aromatics, and non-hydrocarbons containing sulphur, nitrogen, oxygen, and metals. In the hydrocarbon tendency to smoke decrease in the order Aromatics>Naphthenes>Isoparaffins>Paraffins. Kerosene is treated with sulphur dioxide to decrease aromatic content.

Q4: What is the significance of cloud point and pour point?

A4: Cloud point generally determined for products that are transparent in a 40-mm thick layer and have cloud point below 49°C. It gives a rough idea of the temperature above which the oil can be safely handled without any fear of congealing or clogging. Pour point is a well-established test to estimate the temperature at which a sample of oil becomes sufficiently solid to prevent its movement by pumping.

Q5: What is ASTM distillation?

A5: It is a batch distillation with one equilibrium stage, no reflux and minimum separation of the components.

- ASTM method D86 (atm. Press.): Gasoline, Kerosene, gas oil and similar light and middle distillates.
- ASTM method D1160 (max. temp. 400°C, min.1mmHg): For heavy petroleum fractions which tend to decompose at atm. Pressure
Q6: What is TBP distillation?

A6: Distillation characteristics of a crude are assessed by performing a preliminary distillation called ‘True Boiling Point’ analysis (TBP). It is performed in columns with 15 theoretical plates and a reflux ratio of 5. Operation at 760mm Hg for BP below 400 °C. for lighter fractions. For higher boiling point fractions, the distillation is conducted at even 0.5mm Hg. Degree of separation for a TBP distillation test is much higher than those of the ASTM distillation test, its IBP lower and EP higher than ASTM.

\[ TBP = a \ast (ASTM \ D86)^b \]
where ‘a’ and ‘b’ are constants varying with percent of liquid sample distilled.

Q7: What is ASTM gap and TBP overlap?

A7: ASTM gap: Diff. between 5% B.P of heavy and 95% B.P. of preceding cut.

TBP overlap: Diff. between FBP and IBP of successive fractions

Q8: What is overflash?

A8: It is a portion of total vapor leaving the flash zone boiling above the nearest side draw fraction but never included in that fraction. Increase in over-flash decreases the side draw temperatures from the second draw onwards.

Q9: What are the different type of reflux used in distillation column?

A9: Overhead reflux: Part of light naphtha returned to column

Pump around reflux: Liquid withdrawn at a point below a side stream tray that is cooled by the cold crude feed and then returned to the column a few trays above the draw tray.

Pump back reflux: In this arrangement reflux is provided at regular intervals.