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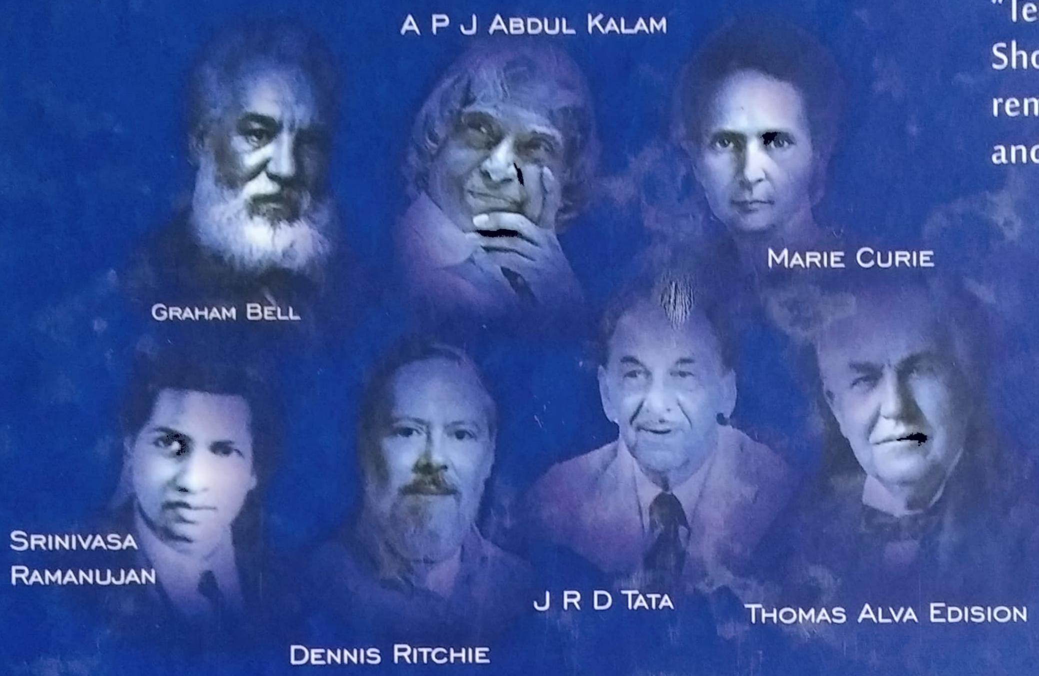

"Tell me and I'll forget; Show me and I may remember; Involve me and I'll understand"

PRACTICAL RECORD

NAME : Nikhil bharadwaj.v

SEM/ BRANCH : Vth Sem 'A' Mechanical

SUBJECT & CODE : Energy conversion lab

USN : 1 K S 1 8 M E 0 4 0

K.S. INSTITUTE OF TECHNOLOGY

VISION

"To impart quality technical education with ethical values, employable skills and research to achieve excellence"

MISSION

* To attract and retain highly qualified, experienced & committed faculty.
* To create relevant infrastructure
* Network with industry & premier institutions to encourage emergence of new ideas by providing research & development facilities to strive for academic excellence
* To inculcate the professional & ethical values among young students with employable skills & knowledge acquired to transform the society

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Laboratory Certificate

This is to certify that Mr./Ms. NIKHIL BHARADWAJ.V *has satisfactorily completed the course of experiments in* ENERGY CONVERSION *laboratory, Code* 18MEL58 *prescribed by Visvesvaraya Technological University, Belgaum for the* V th *Semester B.E.* MECHANICAL *Branch in this College during the academic year 20*20 *- 20*21

Name of the Candidate : NIKHIL BHARADWAJ.V

USN : 1KS18ME040 Subject (with code) 18MEL58

Internal assessment marks awarded : $\frac{30}{30} + \frac{09}{10} = \frac{39}{40}$

Signature of Staff Incharge

Date: 18/1/2021

Signature of Head of Department

Head of the Department
Dept. of Mechanical Engg.
K.S. Institute of Technology
Bengaluru - 560 109.

CONTENTS AND EVALUATION

Sl.No.	Date of Conducting Experiment	Date of Submission	Page No.	Title of the Experiment	Assessment Marks			Signature of Staff with Date
					Experiment 10 Marks	Record 5 Marks	Total	
1	16/10/2020	15/1/2021	1	Cleveland apparatus			30	
2	6/11/2020	15/1/2021	2	Pensky martens apparatus			30	
3	13/11/2020	15/1/2021	3-4	Redwood viscometer			29	[signature] 18/1/2021
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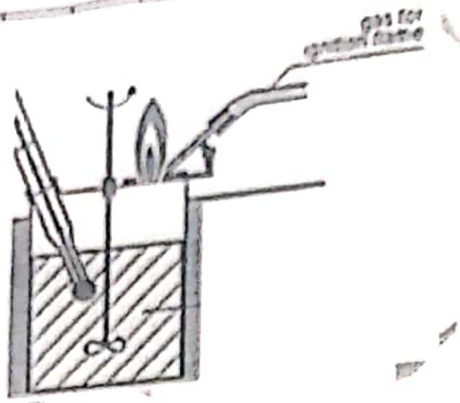
5	10/12/2020	15/1/2021	7-8	Valve Timing diagram			30	
6	17/12/2020	15/1/2021	9-11	Performance test on a 4-Stroke Petrol Engine			30	
7	24/12/2020	15/1/2021	12-14	Performance characteristics of a variable compression ratio Petrol engine			30	
8	31/12/2020	15/1/2021	15-18	Performance test on a 4-S vertical Cylinder diesel Engine			30	



Cleveland Apparatus

Tabular Column:

Temperature °C	Remarks	Flash Point °C	Fire Point °C
30	No flash		
35	No flash		
40	No flash		
45	No flash		
48	Flash	48°c	
55	Flash		
60	Fire		60°c

DATE .... EXP. NO. 1 | EXPT. TITLE : CLEVELAND APPARATUS | PAGE NO. 1

Aim:- To determine the flash and fire point of the lubricating oil using cleveland apparatus.

APPARATUS:- cleveland flash and fire point apparatus, thermometer and Broom sticks.

PROCEDURE:-

1.) The apparatus is setup as shown as in the figure, thermometer is inserted in the oil cup.

2.) Before starting the room temperature is noted. The oil is heated for every 2° rise in temperature is observed for the momentary flash.

3.) The temperature at which flash appears is the flash point and is noted.

4.) The oil is further heated till the oil catches the fire and burns continuously at least for 5 sec and it is the fire point and is noted.

OBSERVATION:

1.) Type of oil:- kerosene

2.) Initial temperature of oil:- 25°C

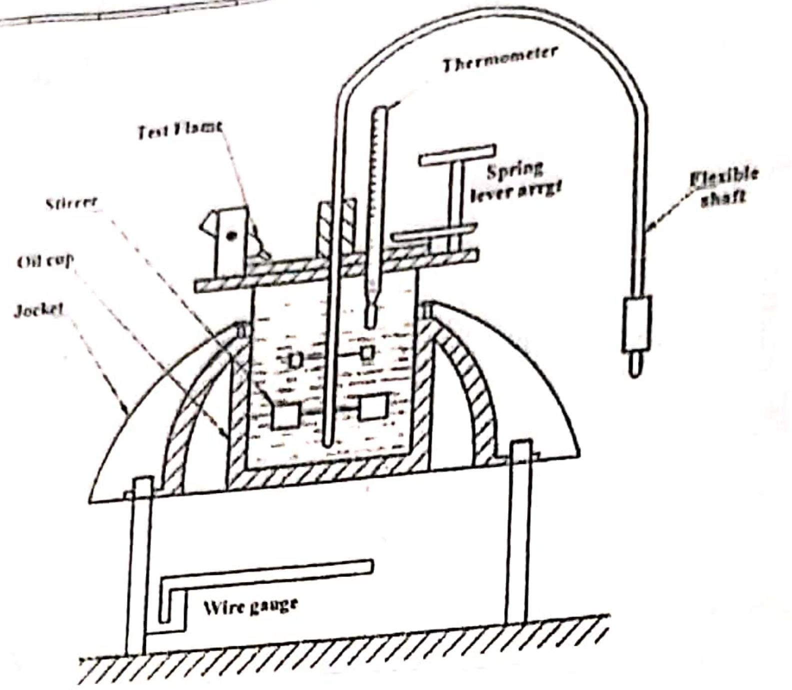
	Marks Allotted
Record	20
Observation	5
Viva	5
Total	30
Signature of Faculty with date	[signature]

RESULT:-

Flash Point of the given oil is 48°C

Fire Point of the given oil is 60°C

30/30



Pensky martenz's flash point apparatus

Tabular column

Temperature °C	Remarks	Flash Point °C	Fire Point °C
30	No flash		
35	No flash		
40	No flash		
43	Flash	43	
45	Flash		
50	Flash		
55	Flash		
60	Fire		60

Aim: To determine the flash and fire point of the lubricating oil by Pensky martens apparatus

APPARATUS: Pensky martens apparatus, thermometer, Broom sticks.

PROCEDURE:

1.) The apparatus is setup as shown in figure, thermometer is inserted in the oil cup.

2.) Before starting the room temperature is noted. The oil is heated for every 2° rise in temperature is observed for the momentary flash.

3.) The temperature at which flash appeares is the flash point and is noted.

4.) The oil is further heated till the oil catches the fire and burns continuously at least for 5 sec and it is the fire point and is noted.

5.) The flame is then put off.

	Marks Allotted
Record	20
Observation	5
Viva	5
Total	30
Signature of Faculty with date	PAD

OBSERVATION:

1.) Type of oil :- Diesel

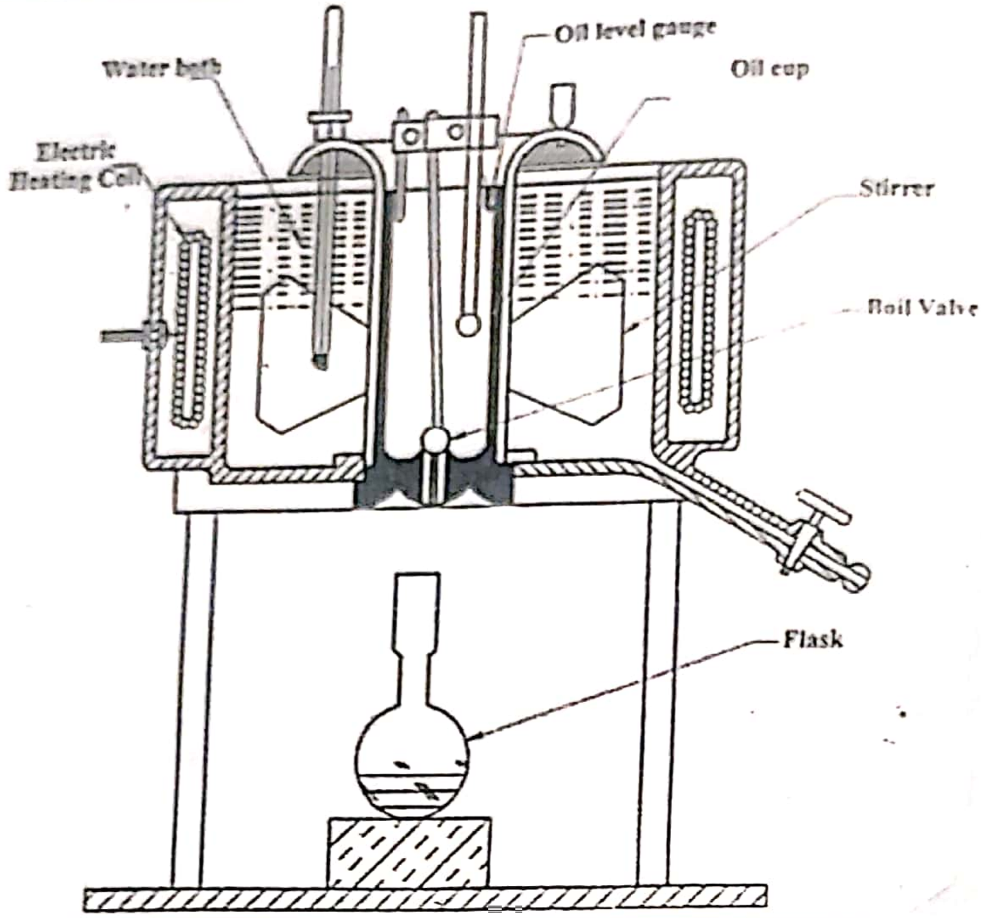
2.) Initial temperature of oil :- 25°c

RESULT:

Flash point of the given oil is 43°c

Fire point of the given oil is 60°c

30/30 PAD



Redwood viscometer Apparatus.

Tabular Column

Sl No	T °c	m_1 kg	m_2 kg	m kg	t s	ρ kg/m³	S	RWN	ν m²/s	μ N-S/m²
1	65	0.050	0.091	0.041	105	820	0.82	17.58	25.48×10^{-6}	0.020
2	75	0.050	0.091	0.041	85	820	0.82	14.23	19.99×10^{-6}	0.016
3	85	0.050	0.091	0.041	75	820	0.82	12.56	17.14×10^{-6}	0.014

where, T = Temperature of oil °c

m_1 = mass of Empty flask, kg

m_2 = mass of flask with oil, kg

m = mass of oil collected, kg = $m_2 - m_1$

t = Time taken for collecting 60cc of oil in seconds

ρ = Density of oil, kg/m³.

Aim:- To determine the kinematic and absolute viscosities of the given oil using red wood viscometer.

APPARATUS: Red wood viscometer, stop watch, 50 ml standard flask thermometer and spirit level

PROCEDURE:

1) The instrument is cleaned and leveled. The oil is poured into the cylinder up to the mark provided the thermometer is placed inside.
2) At the room temperature, time for flow of 50cc into the standard flask is noted.
3) The oil is again poured into the cylinder up to the mark and the heater is switched on.
4) The temperature of oil is subjected as required. The oil and water are continuously stirred during the experiment.
5) When the temperature is steady at the desired value the contact from the orifice is removed to allow the oil to flow into 50ml standard flask.
6) The time taken for 50cc oil flow is recorded.

Calculation

$$\rho = \frac{m}{50\times10^{-6}} = \frac{0.041}{50\times10^{-6}} = 820\,kg/m^3$$

$$S = \frac{\rho}{1000} = \frac{820}{1000} = 0.82$$

$$R_{\text{vw}} = \frac{100\times S\times t}{535\times0.915}$$

$$= \frac{100\times0.82\times105}{535\times0.915}$$

$$= 17.58$$

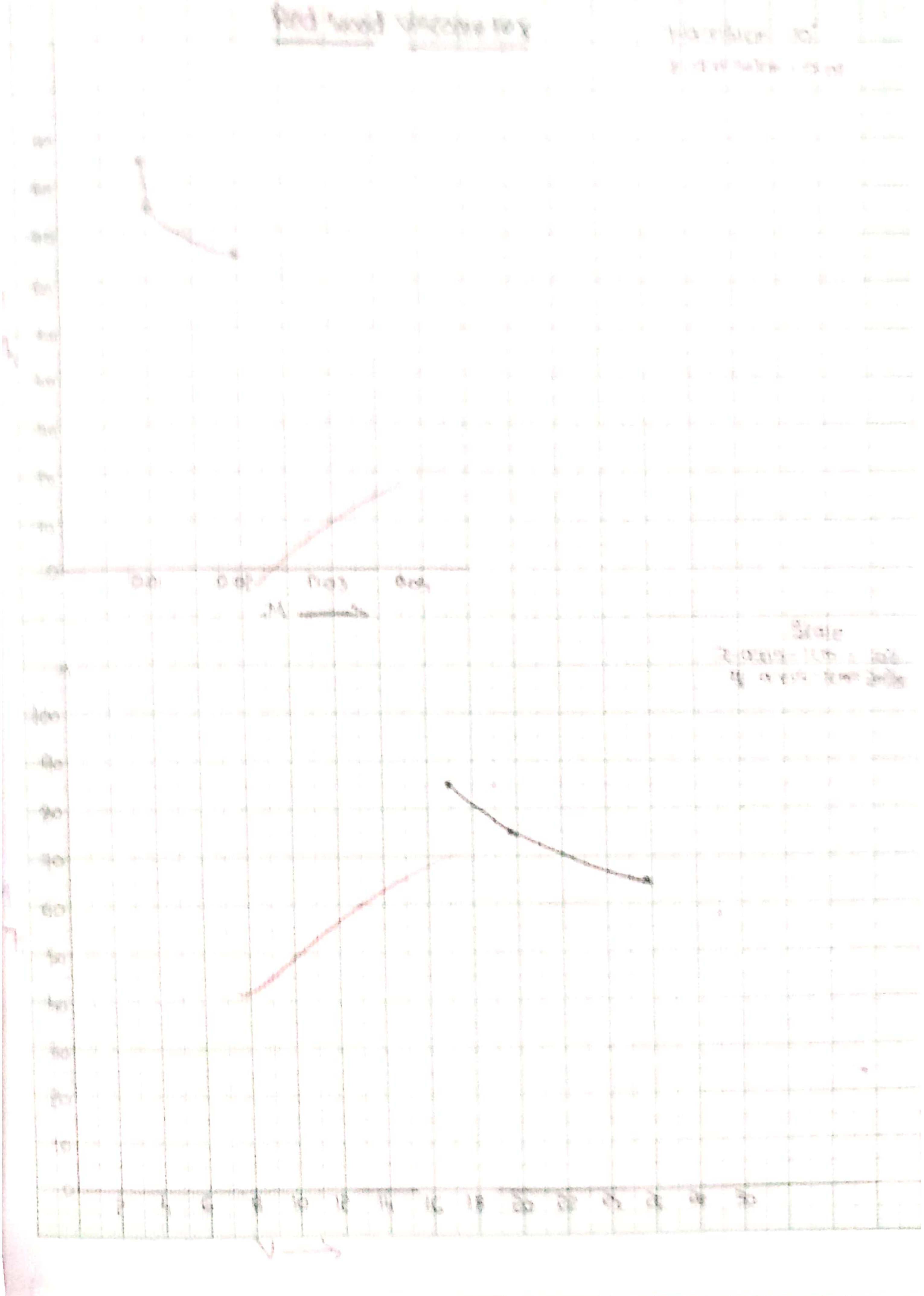
$$V = \left[0.247t - \frac{50}{t}\right]\times10^{-6}$$

$$= \left[0.247\times105 - \frac{50}{105}\right]\times10^{-6}$$

$$V = 25.48\times10^{-6}\,m^2/s$$

$$\mu = V\times\rho$$

$$= 25.48\times10^{-6}\times820 = 0.020\,N\text{-}s/m^2$$



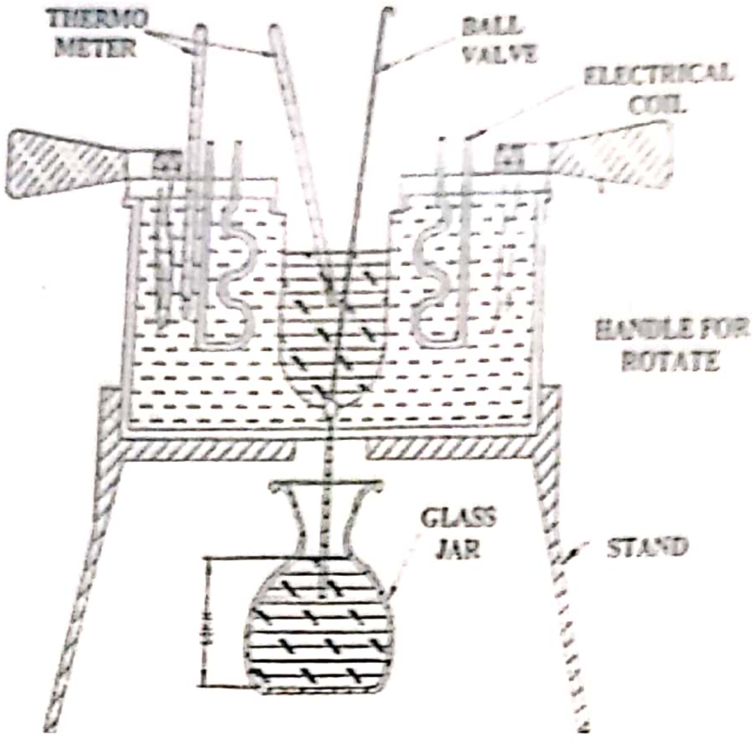
RESULT :

Kinematic viscosity of given oil 25.48×10^{-6} at temperature of 65°c

Absolute viscosity of given oil 0.020 at temperature of 65°c

29/30

	Marks Allotted
Record	20
Observation	5
Viva	4
Total	29
Signature of Faculty with date	[signature]



Saybolt viscometer

Tabular column

Sl No	T °C	m_1 kg	m_2 kg	m kg	t s	ρ kg/m³	ν m²/s	μ N-s/m²
1	55	0.05	0.1	0.05	152	833.3	50.15×10^{-7}	4.179
2	60	0.05	0.1	0.05	128	833.3	42.23×10^{-7}	3.579
3	65	0.05	0.1	0.05	110	833.3	36.20×10^{-7}	3.024

where,

T = Temperature of oil °C

m_1 = mass of Empty flask, kg

m_2 = mass of flask with oil, kg

m = mass of oil collected, kg $= m_2 - m_1$

t = Time taken for collecting 60cc of oil in seconds

ρ = Density of oil, kg/m³

ν = kinematic viscosity, m²/s

μ = Absolute viscosity, N-s/m²

Aim: To determine the viscosity of the given sample of oil using Saybolt Viscometer

Apparatus: Saybolt viscometer, thermometer, stopwatch, 60 cc flask, Balance.

Procedure:

1) The instrument is cleaned and leveled. The oil is poured into the cylinder up to the mark provided the thermometer is placed inside.
2) At the room temperature, time for flow of 60 cc into the standard flask is noted.
3) The oil is again poured in to the cylinder up to the mark and the heater is switched ON.
4) The temperature of oil is adjusted as required. The oil and water are continuously stirred during the experiment.
5) When the temperature is steady at the desired value the contact from the orifice is removed to allow the oil to flow into 60ml standard flask.
6) The time taken for 60 cc oil flow is recorded.

Calculations

i) $\rho = \frac{m}{60\times10^{-6}} = \frac{0.05}{60\times10^{-6}}$

$= 833.3\ kg/m^3$

ii) $\nu = \left(0.33t - \frac{0.18}{t}\right)\times10^{-4}$

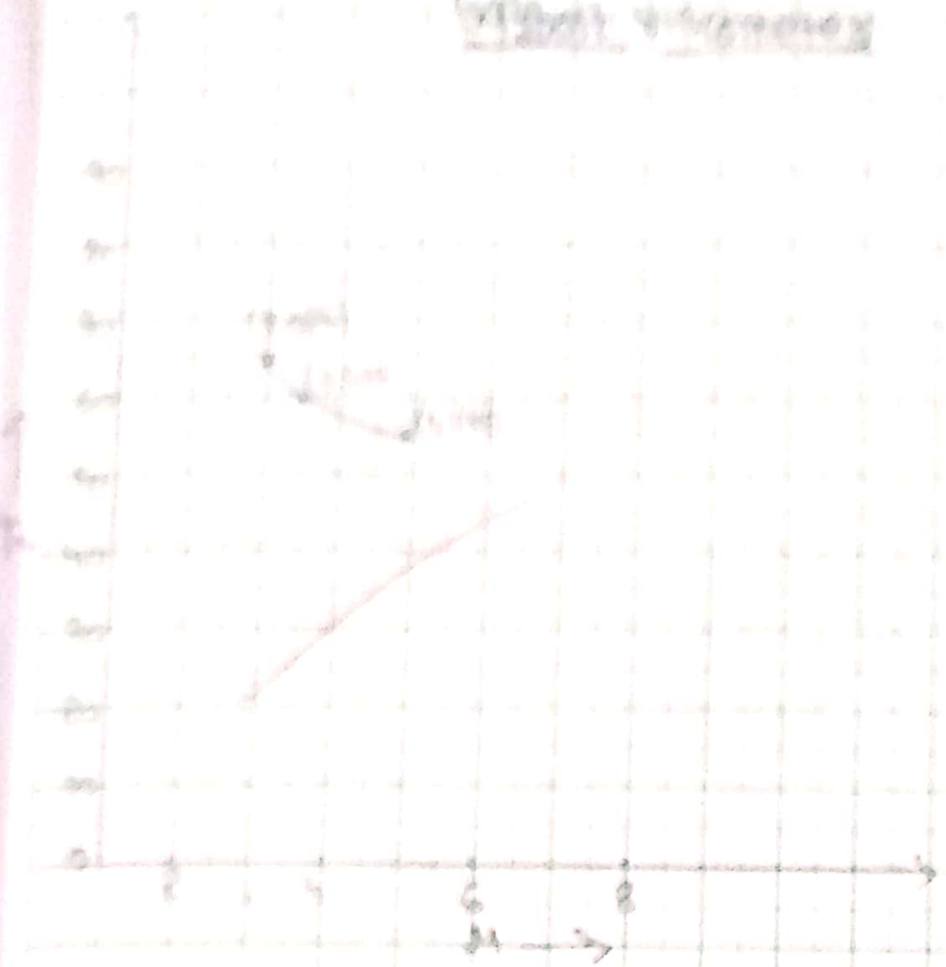
$\left(0.33\times152 - \frac{0.18}{152}\right)\times10^{-4}$

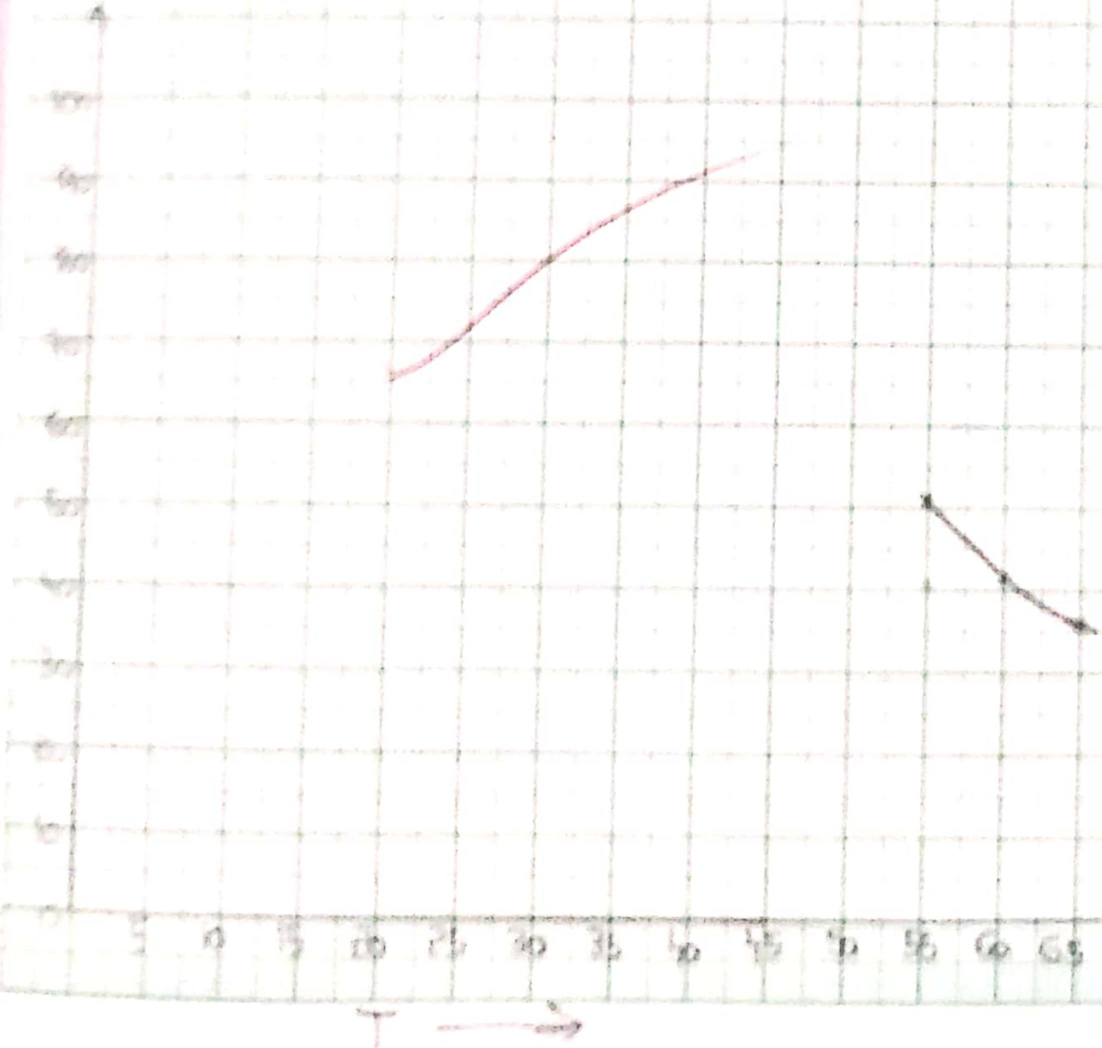
$\nu = 50.15\times10^{-4}\ m^2/s$

iii) $\mu = \rho\times\nu$

$= 833.3\times50.15\times10^{-4}$

$\mu = 4.179\ N\text{-}s/m^2$





Scale

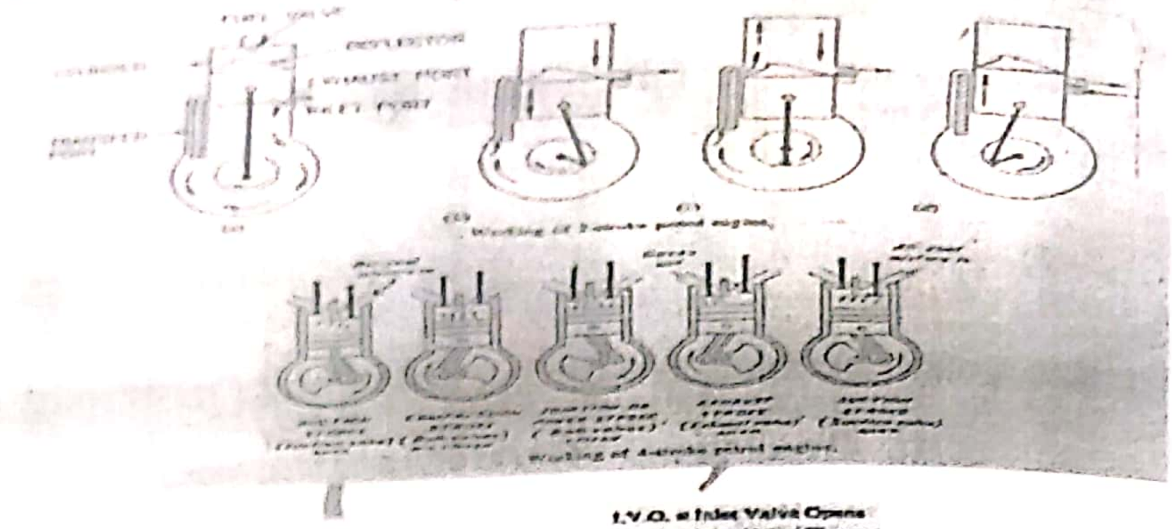
Result.

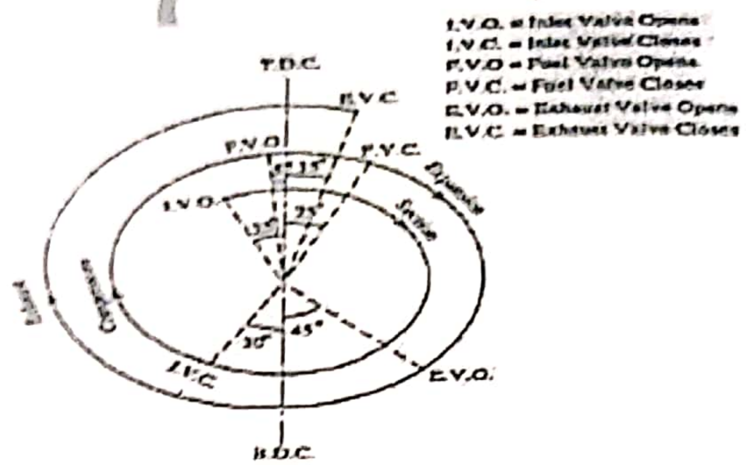
Kinematic viscosity of given oil 50.15 × 10^{-4} at temperature of 55°C

Absolute viscosity of given oil 4.179 at temperature of 55°C

	Marks Allotted
Record	20
Observation	5
Viva	5
Total	30
Signature of Faculty with date	

30/30





valve timing diagram of a four stroke diesel engine

Tabular column

Sl.No	Valve Position	Piston Position	L (cm)	θ°
1	IVO	Before TDC	3cm	8.59
2	IVC	After BDC	14cm	40.10
3	EVO	Before BDC	14cm	40.10
4	EVC	After TDC	3cm	8.59

where,

L = Arc length, cm

θ in degrees

D = fly wheel diameter

Aim:- To draw the valve timing diagram of 4 stroke Engine ~~and to~~

Apparatus:- Given Engine, measuring tape, scale.

Procedure:-

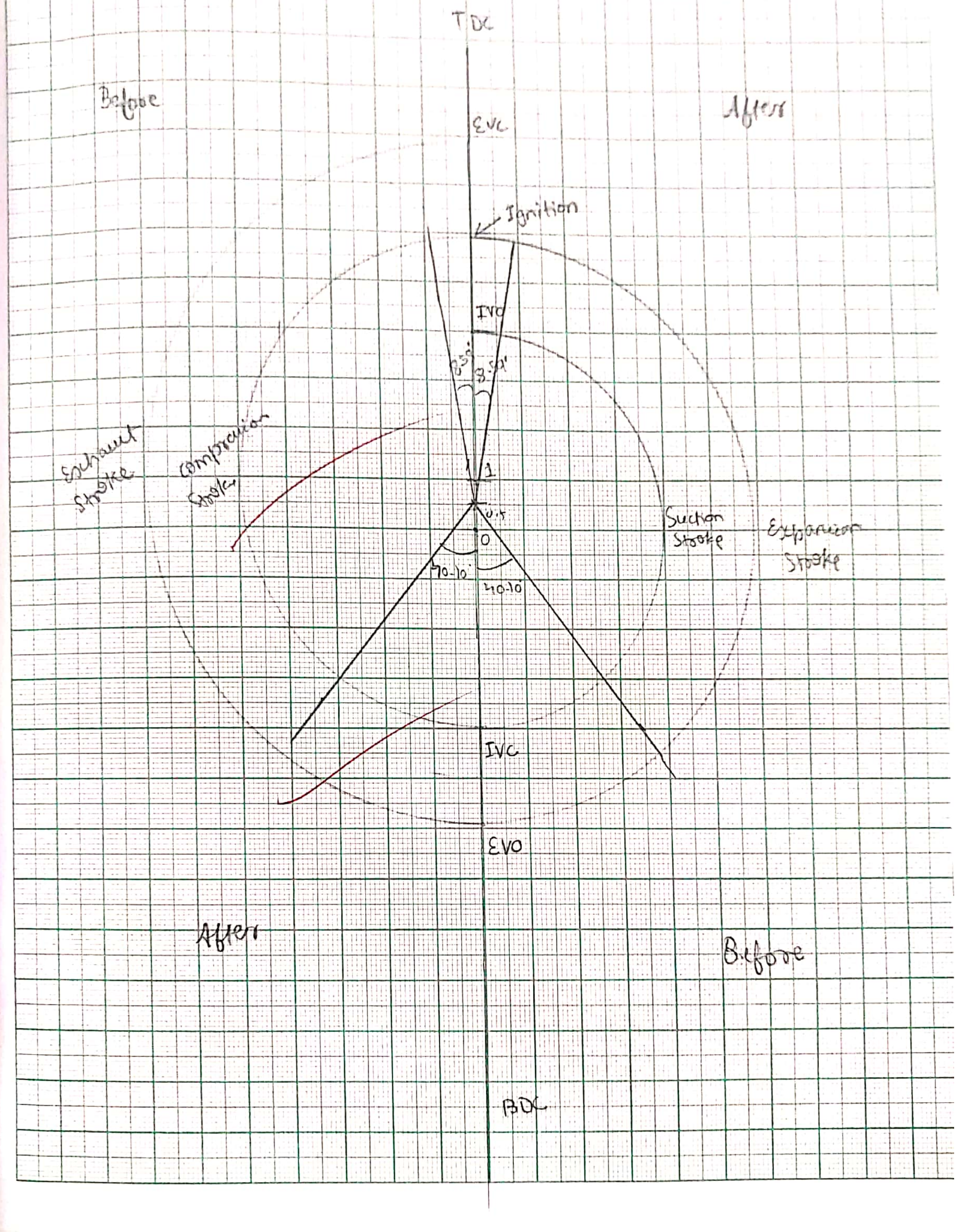
1) Note the location of the inlet and Exhaust valves of the given Engine.
2) The flywheel is turned in clockwise direction and the positions of TDC and BDC are identified with respect to the crank position.
3) The circumferential length of flywheel is measured with help of thread and ruler.
4) The flywheel is turned in clock wise direction and the position and inlet valve begins to open is marker.
5) This point is measured from the initial reference mark (TDC) and this length is noted.
6) The flywheel turned in the same direction and the position of inlet valve closing and Exhaust valve opening and Exhaust valves closing are noted and corresponding length with respective to the reference marks.
7) The reading are recorded in the tabular column and corresponding angles turned (in degrees) are determined.

Calculation

$$\theta = \frac{L \times 360}{\pi \times D}$$

$$= \frac{3 \times 360}{\pi \times 40}$$

$$\theta = 8.59^\circ$$

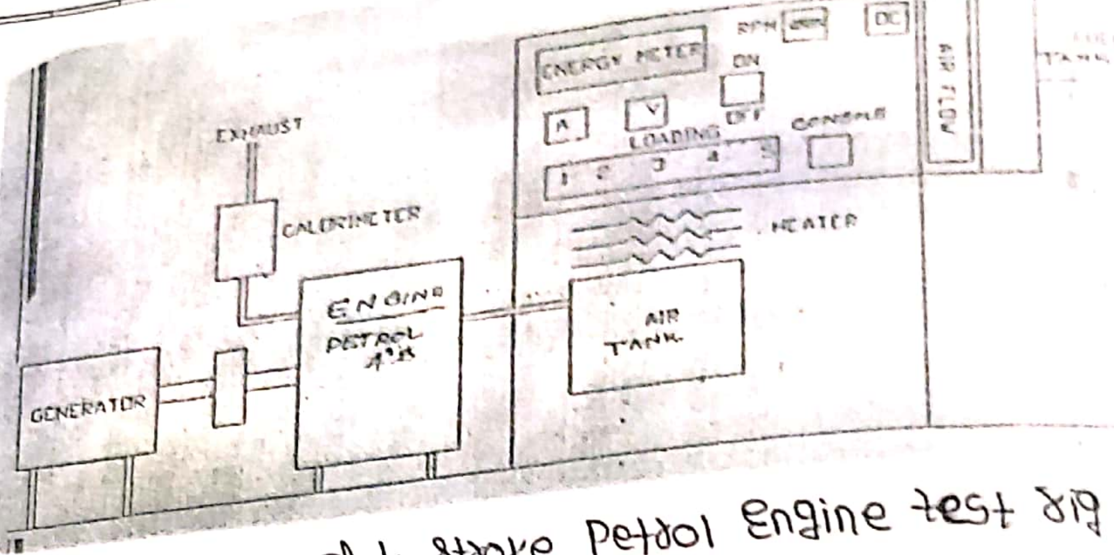

TDC
Before
After
EVC
Ignition
IVC
Exhaust Stroke
Compression Stroke
1
0.5
0
Suction Stroke
Expansion Stroke
IVC
EVO
After
Before
BDC

Result:

The actual valve timing diagram of 4 stroke Engine are drawn

30/30

	Marks Allotted
Record	20
Observation	5
Viva	5
Total	30
Signature of Faculty with date	[signature]



Block diagram of 4 stroke Petrol Engine test rig

Tabular column

Sl No	EL kW	tf s	t s	hw m H2O	mf kg/s	Va m³/s	ma kg/s	Bp kW	BSFC kg/kWh	Qs kW	ηbt	ηv	A:
1	0	45	0	0.038	1.6×10^{-4}	1.22	1.42	0	0	1.4	0	47.6	887
2	0.5	38	25	0.039	1.89×10^{-4}	1.24	1.45	0.48	1.41	7.44	6.48	48.03	7671
3	1	30	25	0.065	2.4×10^{-4}	1.6	1.47	0.48	1.8	9.6	9.65	62.5	612
4	1.5	24	27	0.101	3×10^{-4}	2	2.3	0.44	2.45	12	3.6	78.12	7666
5	2	22	12	0.149	3.27×10^{-4}	2.43	2.8	1	1.17	12.8	7.81	64.92	8562

Where,

E_L = Electrical load applied, kW

t_f = Time taken for 10cc of fuel consumption, sec

t = Time taken for n revolutions of Energy meter disk, sec

h_w = Difference in manometer head, meter of water, m of H2O

m_f = Mass of fuel kg/s

V_f = volume of fuel consumed = 10cc

S = Specific gravity of fuel

t = time taken for 10cc fuel consumed, sec

V_a = Actual volume of air consumed, m³/s

Cd = coefficient of discharge = 0.62

Aim:- To determine the Performance characteristic of a 4-Stroke Petrol Engine.

Apparatus: 4-Stroke Petrol Engine test rig, Stop watch, fuel Etc.

Procedure:-

1.) Check the fuel in the tank
2.) Switch ON the Power Supply & console on the panel board and Ensure ignition Switch in ON.
3.) But keep the loading Switches In off Position initially. Allow the Petrol and Start the Engine by using rope.
4.) Apply the load AC generator by switching on loading switches. Allow some time until the speed Stabilizes.
5.) Repeat the Procedure 4 to 5 different loads at constant Speed i.e 0.5kW load Each.
6.) Tabulate the corresponding readings.
7.) once the Experiment is over keep the ~~contact~~ Petrol control valve in closed Position. And Switch of the console & Power Supply.

Observations:- Specification of Engine:-

Max Power of the Engine = 2.4 kW
Rated speed = 3000rpm
Bore = 70mm
Stroke = 66.7mm
Compression ratio = 4.76:1
Starting of the Engine by rope
loading - Eddy current dynamometer

A_o = Area of orifice
d_o = Diameter of orifice, m
h_a = Head of the air, m
ρ_w = Density of water = 1000 kg/m³
ρ_a = Density of air, kg/m³
P_a = Atmospheric pressure = 101.3 kPa
R = Gas constant for air = 0.287 kJ/kgK
T_a = Ambient temperature, K
m_a = mass of air kg/s
CV = Calorific value kJ/m³
BP = Brake Power kW
n = number of revolution of Energy meter
k = 1500 Energy meter constant
V_s = Swept volume of cylinder m³/s
N = number of revolutions of crank shaft per min.

Calculation

i) $m_f = \frac{V_f \times S}{1000 \times t} = \frac{10 \times 0.72}{1000 \times 38} = 1.89 \times 10^{-4}$ kg/s

ii) $V_a = C_d \times A_o \times \sqrt{2gh_a}$

$A_o = \frac{\pi \times d_o^2}{4} = \frac{\pi \times 0.01^2}{4} = 7.85 \times 10^{-5}$ m

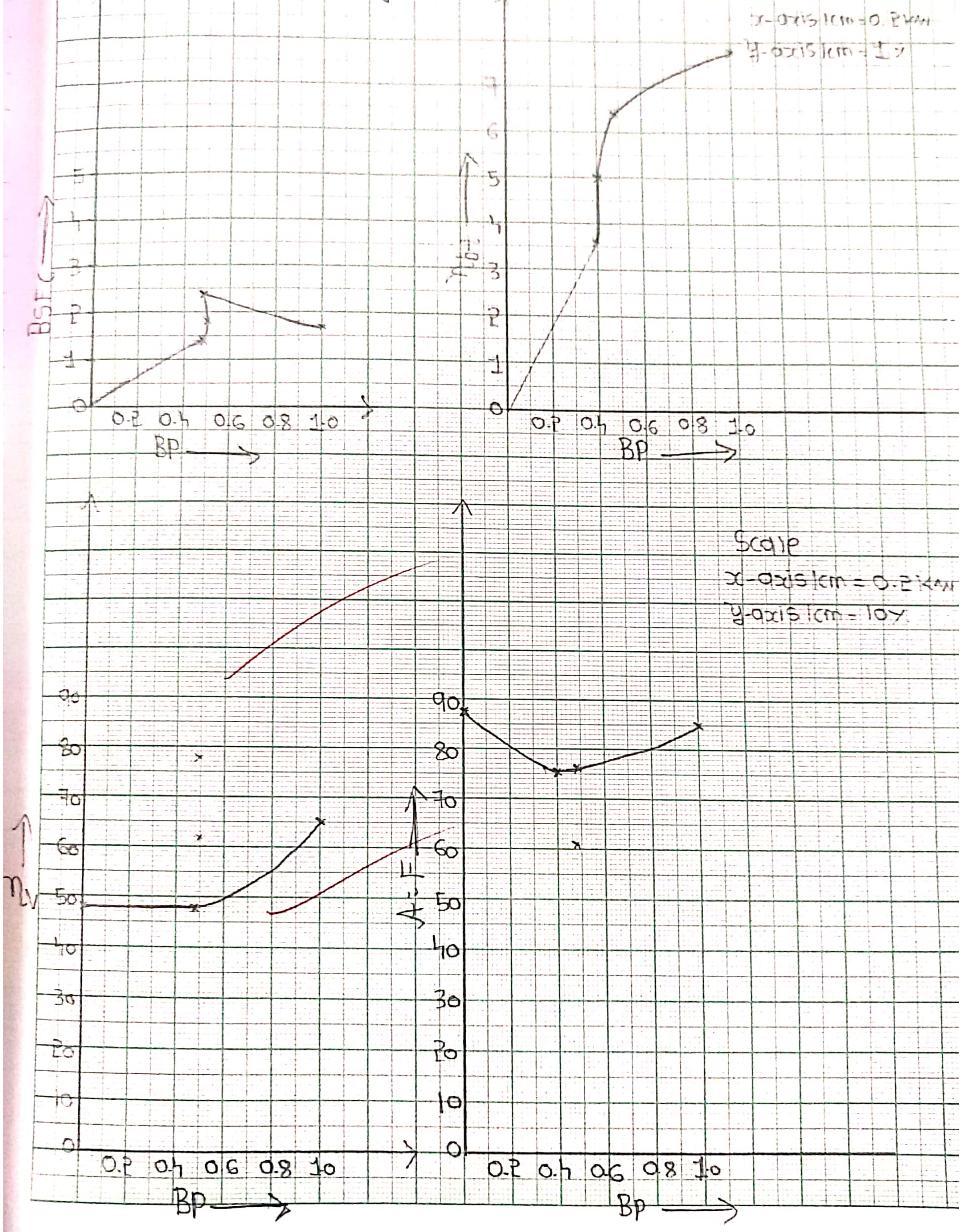
$h_a = \frac{h_w \times \rho_w}{\rho_a} = \frac{0.038 \times 1000}{1.17} = 33.33$

$\rho_a = \frac{P_a}{RT_a} = \frac{101.3}{0.287 \times 300} = 1.17$

$V_a = 0.62 \times 7.85 \times 10^{-5} \times \sqrt{2 \times 9.81 \times 33.33}$

$V_a = 1.24 \times 10^{-3}$ m³/s

Petrol Engine



DATE .... EXPT. TITLE : PAGE NO. 10

EXP. NO. ....

Cooling - air cooling for the cylinder

Diameter of the orifice of the air tank intake = 0.01m

Cd of orifice = 0.62

iii) $m_a = \rho_a \times V_a$

$= 1.17 \times 1.24 \times 10^{-3}$

$m_a = 1.45 \times 10^{-3}$ kg/s

iv) $BP = \frac{3600 \times n}{K \times t} = \frac{3600 \times 5}{1500 \times 25} = 0.48$

v) $BSFC = \frac{m_f}{BP} \times 3600 = \frac{1.89 \times 10^{-4}}{0.48} \times 3600 = 1.41$

vi) $\eta_{bth} = \frac{BP}{Q_s} \times 100 = \frac{0.48}{7.56} \times 100$

$= 6.45\%$

$\eta_v = \frac{V_a}{V_s} \times 100 = \frac{1.24 \times 10^{-3}}{2.56 \times 10^{-3}} \times 100$

$= 48.43\%$

$V_s = \frac{\pi D^2 L N}{60 \times 4 \times 2} = \frac{\pi \times 0.07^2 \times 0.0667 \times 1200}{60 \times 4 \times 2}$

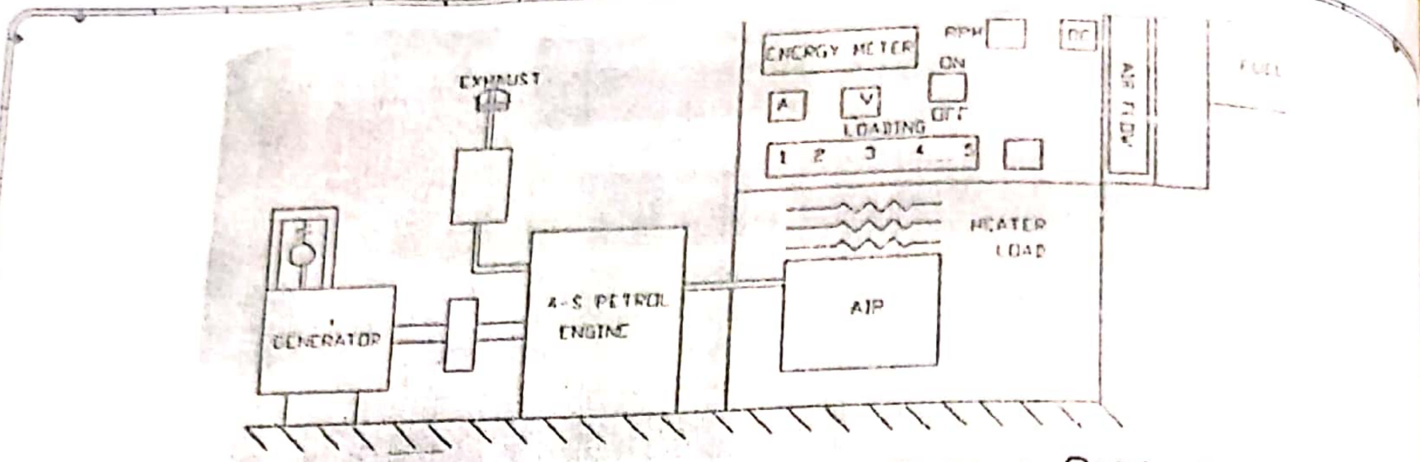
$= 2.56 \times 10^{-3}$

$A:F = \frac{m_a}{m_f} = \frac{1.45}{1.89 \times 10^{-4}} = 7.67$

Result:-
The maximum brake thermal efficiency was found to be 7.81 % at 2 load.

	Marks Allotted
Record	20
Observation	5
Viva	5
Total	30
Signature of Faculty with date	

30/30



Block diagram of VCR 4 stroke petrol engine test rig

Tabular column

Standard head

Sl. no	E_L kW	t_f s	t s	h_w m H_2O	m_f kg/s	V_a m^3/s $\times10^{-4}$	m_a kg/s $\times10^{-4}$	BP kW	BSFC kg/kWh	Qs kW	η_{bt}	η_v	A:F
1	0	35	0	0.021	2.05×10^{-4}	9.10	1.06	0	0	8.2	0	42.7	5.21
2	0.5	31	62	0.023	2.32×10^{-4}	9.55	1.12	0.19	4.397	9.8	2.04	44.7	4.82
3	1	29	26	0.024	2.48×10^{-4}	9.73	1.14	0.46	1.94	9.9	4.68	45.6	4.59
4	1.5	33	20	0.023	2.16×10^{-4}	9.33	1.12	0.41	1.91	8.7	4.7	52.03	5.13

where, E_L = Electrical load

t_f = Time taken for 10cc fuel consumption

t = Time taken for n revolutions

h_w = Difference in manometer head

V_f = volume of fuel consumed

V_a = Volume of air consumed

BP = Brake Power

A_o = Area of orificemeter

m_a = mass of air

C_v = calorific value

h_a = head of air

S = Specific gravity of fuel.

Aim: To determine the performance characteristics of a variable compression ratio of petrol engine test rig at different compression ratio and at a fixed speed.

Apparatus: variable compression ratio petrol engine test rig, air inlet tank, digital tachometer, energy meter, temperature indicator.

Procedure:

1) Fill the fuel tank with neat petrol
2) Check the sufficient lubricating oil in the oil pump
3) connect the control panel to electrical mains i.e 440 volts, 3 phase, 15A neutral connection.
4) Select the compression ratio by using proper combination of head and spacer.
5) Keep the engine throttle to fully open position.
6) Put on the mains to check mains on indicator.
7) Put on the console, blower of DC machine is running and all the indicating instruments glow
8) Block the dynamometer torque arm.
9) Push he ~~start~~ button so that engine starts.
10) Switch on the electrical loading resistance.
11) Unlock the torque arm and make it horizontal by taking the reading in spring balance.
12) For different load positions control the speed at constant value. take down the reading for different parameter and tabulate them.
13) After the experiment is over, close the petrol valve inlet to

0.5 Head

Sl no	EL kW	tf s	t s	hw m of H_2O	mf kg/s	va m^3/s	ma kg/s	Bp kW	BSFC kg/kWh	Qs kW	η_{bt}	η_v	A:F
1	0	51	0	0.021	2.95	9.13	1.06	0	0	8.2	0	42.72	7.57
2	0.5	48	68	0.023	2.56	9.55	1.11	0.17	3.17	9.2	2.04	44.7	4.82
3	1	24	26	0.024	2.48	9.7	1.13	0.46	1.84	9.3	4.58	45.6	4.59
4	1.5	35	29	0.027	2.13	9.33	1.12	0.41	4.31	8.7	4.70	52.03	5.13
5	2	28	32	0.024	2.57	9.10	1.67	0.67	2.50	10.2	3.04	56.2	4.19

Calculation

$$m_f = \frac{V_f \times S}{1000 \times t_f} = \frac{10 \times 0.72}{1000 \times 35} = 2.05 \times 10^{-4}$$

$$V_a = C_d \times A_o \times \sqrt{2 g h_a}$$
$$= 0.62 \times 7.85 \times 10^{-5} \sqrt{2 \times 9.81 \times 17.9}$$
$$V_a = 9.10 \times 10^{-4}$$

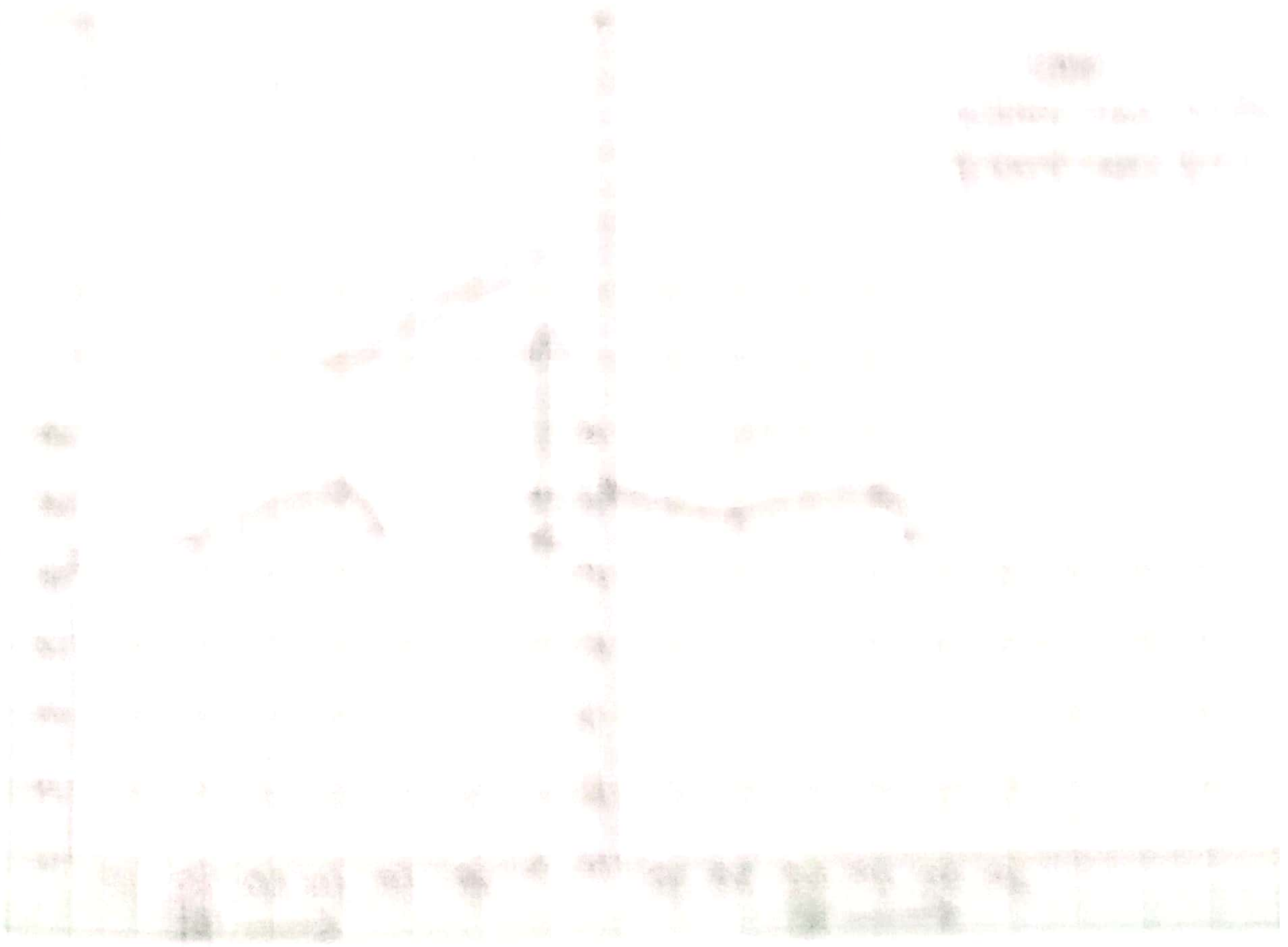
$$m_a = \rho_a V_a$$
$$m_a = 1.17 \times 9.10 \times 10^{-4}$$
$$m_a = 1.06 \times 10^{-3}$$

$$BP = \frac{3600 \times n}{K \times t} = \frac{3600 \times 5}{1500 \times 0} = 0$$

$$BSFC = \frac{m_f}{BP} \times 3600 = 0$$

$$\eta_{bt} = \frac{BP}{Q_s} \times 100 = 0$$

$$\eta_v = \frac{V_a}{V_s} = \frac{9.10 \times 10^{-4}}{2.73 \times 10^{-3}} = 42.7\%$$



the carburetor to avoid riching for subsequent start of Engine.

14) Repeat the Experiment for different compression ratio by maintaining the engine speed as constant.

$$A:F = \frac{m_a}{m_f} = \frac{1.06\times10^{-3}}{2.05\times10^{-4}} = 5.21$$

$$h_a = \frac{h_w \times \rho_a}{\rho_a}$$

$$\rho_a = \frac{P_a}{RT} = \frac{101.3}{0.287\times300}$$

$$\rho_a = 1.17$$

$$h_a = \frac{0.021\times1000}{1.17} = 17.9$$

$$V_s = \frac{\pi D^2 L N}{60\times4\times2}$$

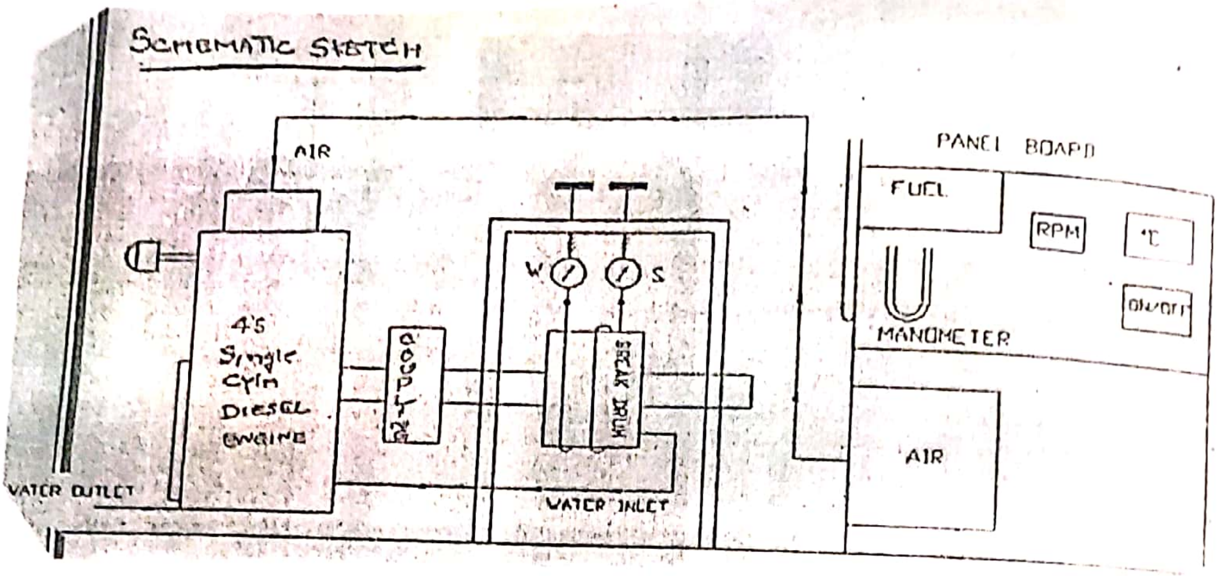
$$= \frac{\pi\times0.07^2\times0.667\times1000}{60\times4\times2}$$

$$= 2.73\times10^{3}$$

Result: At standard head the maximum brake thermal efficiency was found to 4.7 at 1.5kw load

	Marks Allotted
Record	20
Observation	5
Viva	5
Total	30
Signature of Faculty with date	[illegible]

30/30



Block diagram of 4 stroke diesel Engine ~~test~~ rig

Tabular column:

SL no	W kg	N rpm	T N-m	tf S	hw m of H_2O	t S	T_1 °C	T_2 °C	Ta	Tg	mf kg/s	Va m^3/s	ma kg/s	BP kw	BSFC kg/kwh	Qs kw
1	0	1300	0	67	0.01	11	26	26	26	189	1.23	2.51	2.95	0	0	5.446
2	2	1300	3.043	69	0.02	11	26	29	24	204	1.19	3.55	4.70	0.44	10.347	5.257
3	4	1300	6.043	65	0.01	10	26	30	24	222	1.27	2.51	2.95	0.828	5.521	5.603
4	6	1300	9.130	63	0.02	10	26	31	23	237	1.31	3.55	4.17	1.242	3.797	5.790
5	8	1300	12.17	61	0.01	10	26	31	24	245	1.35	2.51	2.95	1.657	2.933	5.979

η_{bt}	Spring constant
0	0
7.83	0.2
14.95	0.6
21.45	0.8
27.95	1.3

DATE ....

EXP. NO 8

EXPT. TITLE PERFORMANCE TEST ON A 4-STROKE VERTICAL SINGLE CYLINDER DIESEL ENGINE

Aim: To conduct a performance test on a mechanically loaded single cylinder 4-stroke diesel Engine and to draw the heat balance sheet

Apparatus: Single cylinder diesel Engine test rig, stop watch, fuel beaker, Etc.

Procedure:

1.) Switch on the Power Supply to the Panel board and Start the Engine by cranking.
2.) Maintain the Speed of Engine as constant and note down the Speed
3.) The Engine is loaded by applying the mechanical load on the brake drum and different reading are noted.
4.) The temperature of cooling water at inlet and outlet is noted the quantity of fuel supply is also measured.
5.) The Load on the Engine is increased gradually and different readings are noted again the experiment is conducted for different loads 2kg, 4kg, 6kg, 8kg, and 10kg.
6.) Note down all the readings and calculate the requirement.

Observation:

Calorific Value of diesel = 44100 KJ/kg

Specific gravity of diesel = 0.8275

Compression ratio of Engine = 16:1

Bore = 80mm

Length of the Stroke, L = 110mm

Rated Speed of the Engine = 1200rpm

Rated Power = 3.68 KW

Sl.no	A:F	FP	IP	η_m
		2.4	2.4	0
1	23.93	2.4	2.814	14.71
2	34.01	2.4	3.224	25.65
3	23.22	2.4	3.640	34.06
4	31.78	2.4		
5	21.79	2.4	4.057	40.84

Calculations

1) $T = (w-s) \times Re \times 9.81$

$Re = \frac{D+d}{2} = \frac{350\times10^{-3}+0.015}{2} = 0.1825 \Rightarrow Re = 35mm$

$T = (2-0.3)\times 0.1825\times 9.81 = 3.04 N\text{-}m$

2) $m_f = \frac{V_f \times S}{1000\times t}$

$V_f = 10cc$ of fuel consumed

$S = 0.8275$

$m_f = \frac{10\times0.2}{1000\times67} = 1.23\times10^{-4}$ kg/s

3) $V_a = C_d \times A_o \sqrt{2gh_a} = 0.62\times3.14\times10^{-4}\sqrt{2\times9.81\times8.503}$

$A_o = \frac{\pi\times0.02^2}{4} = 3.14\times10^{-4}$ $\quad = 2.51\times10^{-3}$

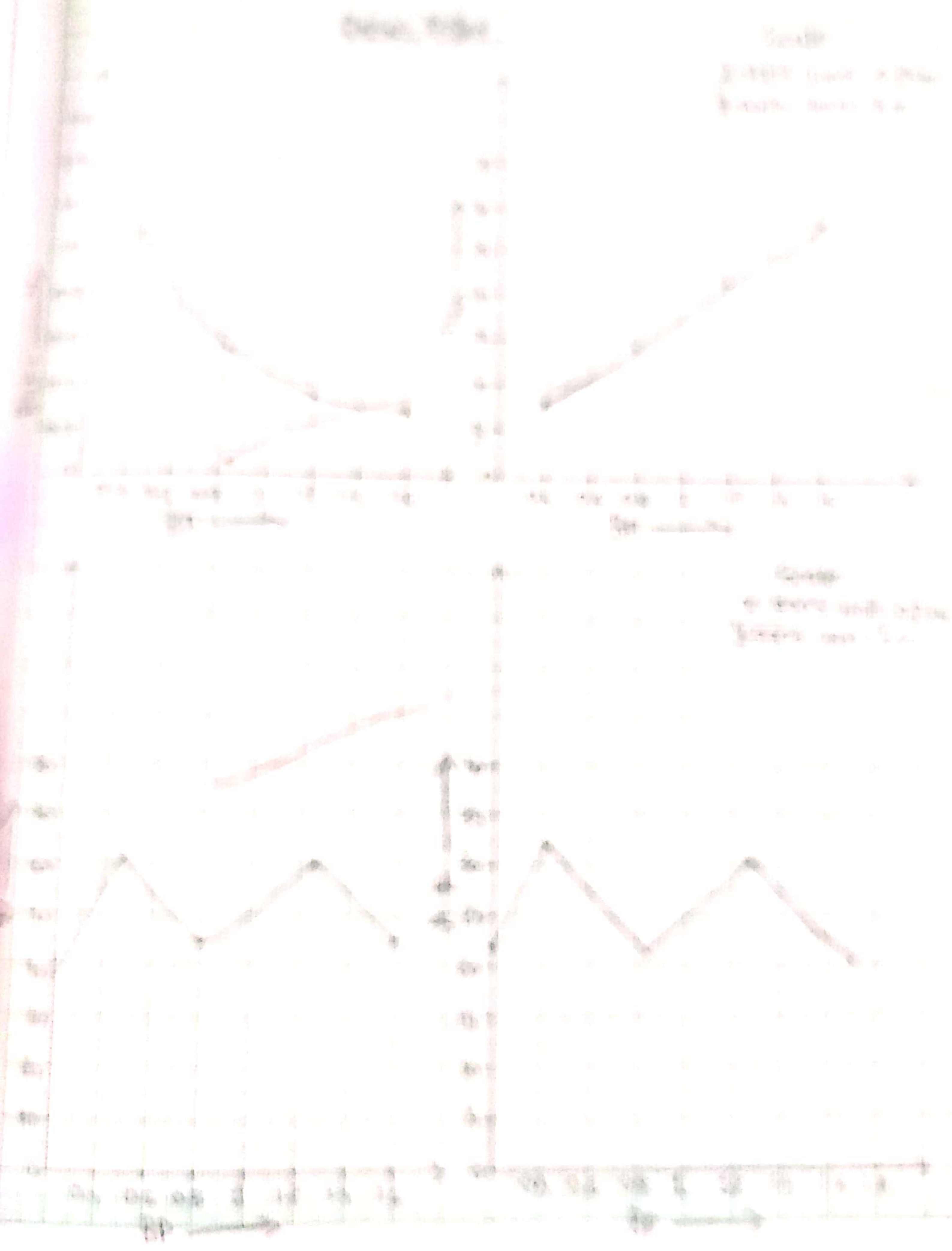
$h_a = \frac{h_w\times\rho_w}{\rho_a} = \frac{0.01\times1000}{1.17} = 8.503$

$\rho_w = 1000$

$\rho_a = \frac{P_a}{RT_a} = \frac{101.3}{0.287\times300} = 1.17$

4) $m_a \Rightarrow m_a = \rho_a \times v_a = 1.17\times2.51\times10^{-3} = 2.93\times10^{-4}$

5) $BP = \frac{2\pi NT}{60\times1000} = \frac{2\pi\times1300\times3.04}{60\times1000} = 0.414$



Brake drum diameter = 350mm
Rope diameter = 0.015m

6.) $BSFC = \frac{mf}{BP} \times 3600 = \frac{1.08 \times 10^{-4} \times 3600}{0} = 0$

7.) $Qs = mf \times CV = 1.23 \times 10^{-4} \times 44100$
$= 5.44\,kW$

$CV = 44100$

8.) $\eta_{bt} = \frac{BP}{Qs} = \frac{0.43}{4.76} \times 100 = 9.2$

9.) $\eta_v = \frac{Va}{Vs} \times 100 = \frac{0.43}{5.88 \times 10^{-3}} \times 100 = 10.35$

$Vs = \frac{\pi D^2 L N}{60 \times 4 \times 2} = \frac{\pi \times (0.05)^2 \times (0.1)(1300)}{60 \times 4 \times 2} = 2.127 \times 10^{-3}$

10.) $A:F = \frac{ma}{mf} = \frac{2.95 \times 10^{-4}}{1.23 \times 10^{-4}} = 23.935$

$IP = BP + FP = 0 + 2.4 = 2.4$

$\eta_m = \frac{BP}{IP} \times 100 = \frac{0}{2.4} \times 100 = 0$

Scanned with CamScanner

Scale

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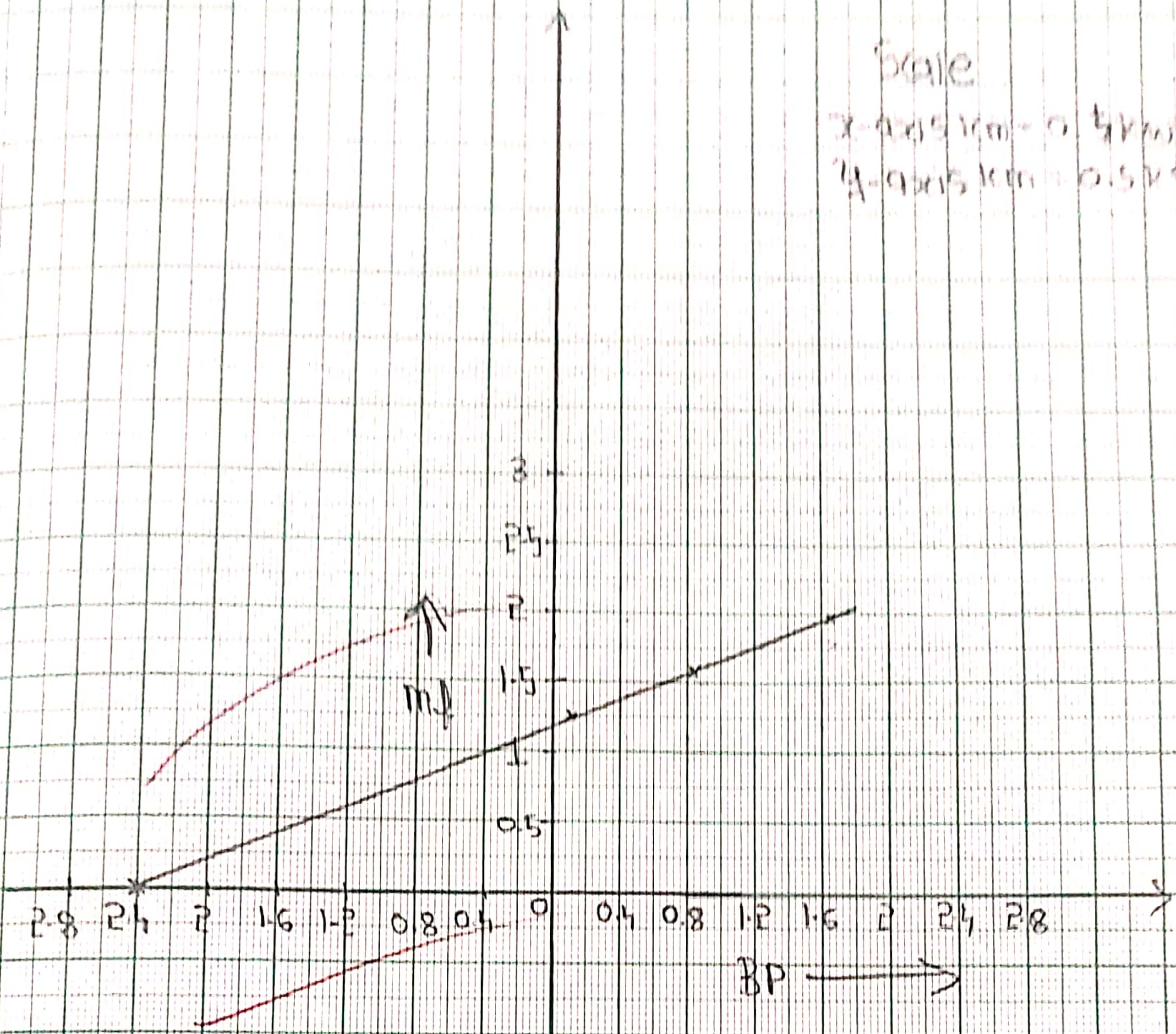

Heat balance sheet on ...

Sl No	Details	Heat in kJ/min	%
		3587.9 kJ/min	100
1	Heat supplied Qs	99.62	8.76
2	Heat Equivalent of BP	144	4.81
3	Heat Equivalent of FP	125.01	3.58
4	Heat absorbed by cooling water	43.5	1.71
5	Heat carried away by Exhaust gas	3175.3	81.55
6	Unaccounted heat	3087.3	

1.) $Qs = mf \times Cv \times 60$
$= 3.356 \times 44100 \times 60 = 3587.97 \text{ kJ/min}$

2.) Heat Equivalent to BP
$= BP \times 60 = 1.657 \times 60 = 99.62 \text{ kJ/min}$

3.) Heat Equivalent of FP
$= FP \times 60 = 2.4 \times 60 = 144$

4.) Heat absorbed by cooling water
$m_w = \frac{1600 \times 60}{10} = 600$

$m_w C_{pw} (T_2 - T_1) = 6000 (4.187)(31-26) = 125.01 \text{ kJ/min}$

5.) $m_w = m_g \times C_{pg} \times (t_g - T_a) \times 60 = (3.091 \times 10^{-3}) \times 1.063 \times (25\text{-}$
$= 43.58$

6.) Unaccounted heat $= 1-2-3-4-5 = 3587.97 - 99.62 - 144 - 125$
435
$= 3087.3$

Result :

Performance of 4-stroke diesel engine is found to be 40.84 at 8kg load.

	Marks Allotted
Record	20
Observation	5
Viva	5
Total	30
Signature of Faculty with date	[signature]

30/30

K. S. INSTITUTE OF TECHNOLOGY, BENGALURU – 560109
DEPARTMENT OF MECHANICAL ENGINEERING
RUBRICS FOR EVALUATION OF EXPERIMENTS IN LAB

COURSE: Energy Conversion Lab
COURSE CODE: 18MEL58

Sl No	Particulars	Max Marks	Reduced to
1	Lab OBSERVATION BOOK	10 marks	5 marks
2	Lab RECORD BOOK	20 marks	20 marks
3	Lab VIVA-VOCE	5 marks	5 marks
	Lab Test	100 marks	10 marks
	Total -CIE		**40 marks**

GUIDELINES FOR EVALUATION

Lab OBSERVATION BOOK (Max. 10 marks)

	Proficient(4 marks)	Adequate(3 marks)	Substandard (1-2 marks)	Unacceptable (0 marks)
Conduction of experiments *(Max. 4 marks)*	Student demonstrates an accurate understanding of the experiment's aim and concepts.	Student arrives on time to lab, but may be unprepared.	Student tardiness or unpreparedness makes it impossible to fully participate.	Student was absent from lab or did not participate. There was no attempt to make prior arrangements to make up the lab.
Knowing the principle of working *(Max. 4 marks)*	The student can correctly answer questions and if appropriate, can explain concepts/principles to fellow classmates.	Answers to questions about concepts/principles but not fully grasped.	Student has difficulty in explaining key lab concepts/principles.	
Involvement in calculation and graphs to obtain the results *(Max. 2 marks)*	Student is eager to participate to calculate the readings and plots graphs independently *(2 marks)*	Student tardiness to do the calculations *(1 mark)*		

Lab RECORDBOOK (Max. 20 marks)

	Proficient(4-5 marks)	Adequate (3 marks)	Substandard (1-2 marks)	Unacceptable(0 marks)
Have Knowledge of contents (viz; sketches, tabular column with units etc.) *(Max. 5 marks)*	Student demonstrates an accurate understanding of the contents written.	Student has a basic knowledge of content, but may lack understanding of some concepts.	Student appears to have not fully grasped the lab content	Student submitted content is unacceptable.
Result and Graphs content *(Max. 5 marks)*	Results and Graphs are neat, creative and include complete titles and accurate units	Results and Graphs could have been done more neatly/ accurately	Results and Graphs possess multiple errors.	Results and Graphs not submitted
Analyzing and Concluding *(Max. 5 marks)*	Provides rich analysis of the data and Draws valid/insightful conclusions based on the data	Provides some analysis of the data and Demonstrates some ability to drawconclusions based on the data	Provides limited analysis of the data and Demonstrates limited ability to draw conclusions based on the data	Analysis and Conclusion is NOT done
Submitted in the very next lab*(Max. 5 marks)*	Submitted in the very next lab with full contents	Submitted in the very next lab with incomplete contents	Not Submitted in the very next lab due to genuine reasons	Not Submitted in the very next lab

Lab VIVA-VOCE (Max. 5 marks)

Students answering the following questions (each 1 mark)

1. Questions based on 'fundamentals of the experiment'
2. Questions based on 'concepts/ principles'
3. Question based on 'working procedure'
4. Questions based on the 'significance/importance'
5. Questions based on 'applications'

Signature of Course- Incharge

Signature of HOD

H... of the Department
Dept. of Mechanical Engg.
K.S. Institute of Technology
Bengaluru - 560 109.