TED (21) – 3035
REVISION 2021

QID :

Reg. No. ………..
Name : ………….

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY NOVEMBER 2022

MECHANICAL ENGINEERING

Time: 3 hours | Maximum Marks: 75

PART A

I. Answer all the following questions in one word or sentence.

(9 x 1 = 9 Marks)

		Module Outcome	Cognitive level
1	The ratio of mass to the volume is known as _______________	M1.01	R
2	The sum of Atmospheric pressure and gauge pressure is known as _______________ pressure	M1.02	R
3	Write about Uniform flow of a fluid	M2.01	R
4	Write the continuity equation of a fluid flow	M2.02	R
5	Pelton wheel is an example of ____________ type of turbine	M3.01	R
6	Write two type of reciprocating pump	M3.03	R
7	Write any two application of steam boiler	M4.01	R
8	Using steam turbines HEAT ENERGY of steam is converted into _______________ ENERGY	M4.02	R
9	The bike RX100 uses ___ stroke engine	M4.04	R

PART B

II. Answer any Eight questions from the following

(8 x 3 = 24 Marks)

		Module Outcome	Cognitive level
1	Define Pascal’s law of fluid pressure & write one application of it	M1.03	U
2	The intensity of pressure of water at a point is 290 KPa , express the pressure in terms of head of water	M1.04	A
3	State Bernoulli’s theorem & write one limitation of it	M2.03	U
4	Water flows throught a pipe 200mm diameter 60m long with a velocity of 2.5 m/s. Find the head lost in friction (take f = 0.005)	M2.04	A
5	Define the following terms 1. Water power 2. Brake power	M3.02	U
6	A turbine running with a rotational speed of 100RPM under a head of 10M , developing a power of 20KW. Find out the specific speed of turbine	M3.02	A
7	Explain the selection on KW rating of various pumps based on head	M3.04	U
8	Write about fire tube boiler	M4.01	U
9	Write any three classification of an IC engine	M4.03	U
10	Explain the working principle of impulse turbine	M4.02	U

PART C

Answer all questions from the following. Each question carries seven marks

(6 x 7 = 42 Marks)

		Module Outcome	Cognitive level
III.	The left limb of a manometer is connected to a pipe in which a fluid of specific gravity 0.8 is flowing. The right limb containing mercury is open to atmosphere. The centre of the pipe is 100mm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 250mm.	M 1.04	A
	OR		
IV.	A U-tube manometer is connected to two pipes A & B. Pipe B is 60mm below pipe A. The specific gravity of liquid in pipe A & B is 1.6 and 0.85 respectively. Mercury level in the left limb is 80mm below the centre of pipe A. Find the pressure difference between two pipes , if the level difference of mercury in the two limbs of the manometer is 120mm	M 1.04	A
V.	A venturimeter with inlet diameter 150mm and throat diameter 80mm is laid, its axis horizontal and is used to measure the flow of water. The mercury manometer shows a gauge difference measured as 150mm. Assume the coefficient of meter as 0.95. Calculate the discharge in Litres/sec	M2.04	A
	OR		
VI.	Explain the water hammer and its effects	M2.04	U
VII.	Using simple figure , write about hydroelectric power plant	M3.01	U
	OR		
VIII.	Using simple figure , write about a multistage centrifugal pump used for high discharge	M3.0	U
IX.	Using simple figure , write about double acting reciprocating pump	M3.0	U
	OR		
X.	Distinguish Kaplan turbine & Francis turbine	M3.0	U
XI.	Explain the working of four stroke petrol engine	M4.04	U
	OR		
XII.	Using block diagram , write about a simple vertical boiler	M4.01	U
XIII.	Explain the working of parson’s reaction turbine	M4.02	U
	OR		
XIV.	Distinguish petrol & diesel engine	M4.04	U

Name of Setter :	Name of Scrutinizer :
Signature with date :	Signature with date :
Designation :	Designation :

Scoring Indicators

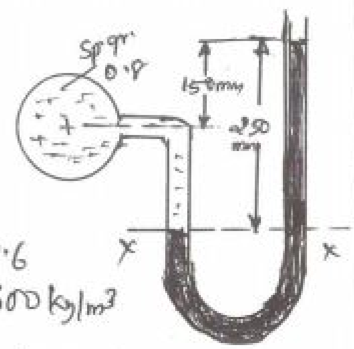
COURSE NAME : MECHANICAL ENGINEERING

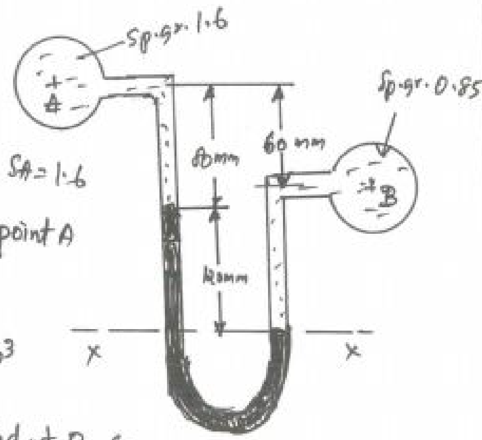
COURSE CODE : 3035 **QID :**

Q No	Scoring Indicators	Splitscore	Sub Total	Total score
	PART A			**9**
I. 1	density	1	1	
I. 2	Absolute pressure	1	1	
I. 3	In **uniform flow** if the velocity at a given instant of time is same in both magnitude and direction at all points in the flow	1	1	
I. 4	A1V1 = A2V2	1	1	
I. 5	Impulse turbine	1	1	
I. 6	Single acting Double acting	0.5*2	1	
I. 7	Steam power plant Steam wash	0.5*2	1	
I. 8	Mechanical energy	1	1	
I. 9	two	1	1	
	PART B			24
II. 1	**The external static pressure applied on a confined liquid is distributed or transmitted evenly throughout the liquid in all directions**	3	3	
II. 2	P = 290KPA p=1000 kg/m^2 h = P / pg = (290*1000) / (1000*9.81) = 29.56 m	1 2	3	
II. 3	The total mechanical energy of the moving fluid comprising the gravitational potential energy of elevation, the energy associated with the fluid pressure and the kinetic energy of the fluid motion, remains constant.	3	3	

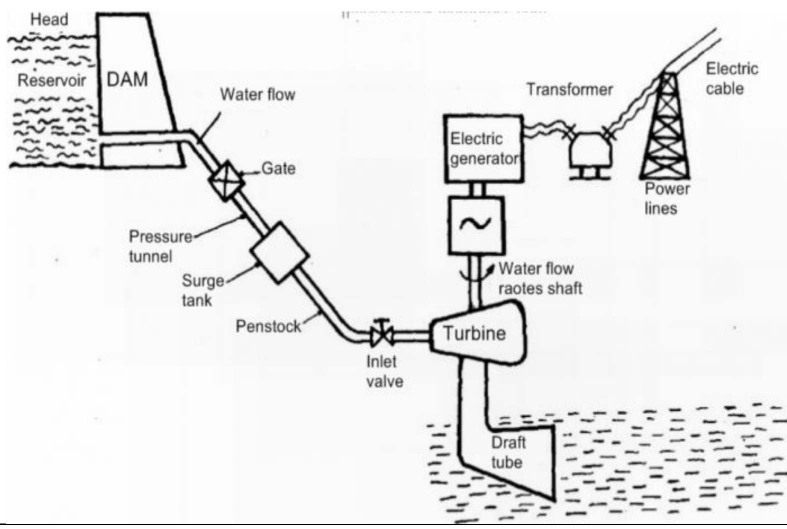
II. 4	Diameter of pipe, d = 200 mm = 0.2 m Length of pipe, l = 60m Velocity of flow, v = 2.5 m/s Friction factor, f = 0.005 Chezy's constant, C = 55 By using Darcy's formula Head lost due to friction, $h_f = \frac{4flv^2}{2gd}$ $= \frac{4 \times 0.005 \times 60 \times (2.5)^2}{2 \times 9.81 \times 0.2}$ **= 1.911 m of water (*Ans*)**	1 1 1	3	
II. 5	WATER POWER (WP) Its defined as the power possessed by water at inlet of turbine BRAKE POWER (BP)(Mechanical Power) Its defined as power developed by turbine due to its running	1.5 1.5	3	
II. 6	N = 100 RPM H = 10M P = 20KW NS = N P / (H ^ 5/4) = 14142.13 / 17.78 = 795.39 RPM	1 2	3	
II. 7	Selection of the pumping equipment is a crucial point that determines both process parameters and in-use performance of the unit under development. During selection of the type of pump three groups of criteria can be distinguished: 1) Process and design requirements 2) Nature of pumped medium 3) Key design parameters	3	3	
II. 8	Hot gases passes through tubes • Water surrounds tubes • Less number of parts • Slow evaporation • Low steam generation • Generate low pressure steam	0.5*6	3	

	• Low overall efficiency • Less maintenance cost • Less operation cost • Less skill required to operates the boiler • Used for industrial application • More safe (due to large water content & low steam generation			
II.9	• Thermodynamic cycle used – Otto cycle, diesel cycle, and dual cycle engine • Fuel used – Petrol engine, diesel engine, gas engine, and kerosene oil engine • Number of strokes for completion of cycle – Four-stroke engine and two-stroke engine	3*1	3	

II.10	High velocity (kinetic energy) steam jet is injected from steam nozzle directed towards blades of turbine , it rotates (mechanical work) Steam jet has certain mass & change of direction of high velocity steam jet produces acceleration , So accelerated mass of steam produces force due to change in momentum , this force acts tangentially on wheel and it rotates	1.5 1.5	3	
	PART C			42
III.	Sp. gr. of oil in pipe $S_1 = 0.8$ Density of oil $\rho_1 = S_1 \times 1000$ $= 0.8 \times 1000 = 800 kg/m^3$ Sp. gr. of mercury $S_2 = 13.6$ Density of mercury $\rho_2 = S_2 \times 13.6$ $= 13.6 \times 1000 = 13600 kg/m^3$  height of liquid in the left limb x-x $h_1 = 250 - 100 = 150 mm = 0.15 m$ Difference of mercury level $h_2 = 250 mm = 0.25 m$ Let 'p' be the intensity of ~~of~~ pressure of fluid flowing in pipe Equating $p + \rho_1 g h_1 = \rho_2 g h_2$ $p + 800 \times 9.81 \times 0.15 = 13600 \times 9.81 \times 0.25$ $\therefore p = 32176.8 N/m^2$ $= 32.18 kN/m^2$	2 2 2 1	7	7

IV.	 Sp. gr. of liquid at A, $S_A = 1.6$ Density of liquid at point A $\rho_A = S_A \times 1000$ $= 1.6 \times 1000$ $= 1600\ kg/m^3$ Sp. gravity of liquid at B, $S_B = 0.85$ Density of liquid at B $\rho_B = S_B \times 1000$ $= 0.85 \times 1000 = 850\ kg/m^3$ Sp. gravity of Hg $S_{Hg} = 13.6$ Density of mercury $\rho_{Hg} = 13.6 \times 1000$ $= 13600\ kg/m^3$ Taking x-x as datum line Pressure above X-X in the left limb $= P_A + \rho_A g \times 0.08 + \rho_{Hg} g \times 0.12$ $= P_A + 1600 \times 9.81 \times 0.08 + 13600 \times 9.81 \times 0.12$ $= P_A + 17265.6$ Pressure above x-x in the right limb $= P_B + \rho_B g (0.08 + 0.12 - 0.06)$ $= P_B + 1167.39$ Equating the two pressure, $P_A + 17265.6 = P_B + 1167.39$ Difference of pressure between two pipes $P_A - P_B = 17265.6 - 1167.39$ $= 16098.21\ N/m^2$ $= 16.1\ KN/m^2$	2 2 2 1	7	7

V.	Diameter of inlet pipe of venturimeter $d_1 = 150mm = 0.15m$ $a_1 = 0.01767 m^2$ Dia. of throat $d_2 = 80mm = 0.08m$ $a_2 = 0.005024 m^2$ Mercury manometer reading 'x' $= 150mm$ $= 0.15m$ of mercury $Cd = 0.95$ Sp. gr. of mercury $Sh = 13.6$ Diffrence of pressure head $h = x\left[\frac{Sh}{Sp} - 1\right]$ $= 0.15\left[\frac{13.6}{1} - 1\right]$ $= 1.89$ m of water Discharge $Q = Cd \times \frac{a_1 a_2}{\sqrt{a_1^2 - a_2^2}} \sqrt{2gh}$ ~~= 0.95 x 0.005024 x 0.01767 x~~ $= \frac{0.95 \times 0.01767 \times 0.005024}{\sqrt{(0.01767)^2 - (0.005024)^2}} \sqrt{2 \times 9.81 \times 1.89}$ $= 0.03033\ m^3/se$ $= \underline{30.33}$ Lt/se	3 3 1	7	7
VI.	Water hammer is a phenomenon of sudden rice in pressure in the pipe. It occurs when fluid flowing inside the pipe is suddenly brought to rest by closing a valve in the pipe. Water hammer can be eliminated by 1. Gradual closure of valve 2. Sudden closure of valve and considering pipe rigid 3. Sudden closure of valve and considering pipe elastic 4. The length of pipe	3 4	7	7

<table>
<tr>
<td>VII.</td>
<td>CONSTRUCTION
1. Dam
2. Penstock
3. Inlet valve
4. Water turbines
5. Electric Generator
6. Draft tube
WORKING
• Water stores using dam
• Penstock pipes transfer water to turbines from dam
• Inlet valve used to control the water flow to turbine
• Water Turbine coupled with generator to produce electricity
•

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3

2</td>
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<td>7</td>
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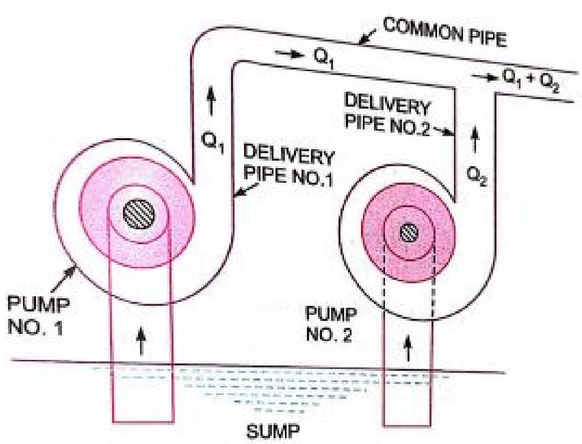
<td>VIII.</td>
<td>Multi stage centrifugal pumps for high discharge:
For obtaining high discharge, the pumps should be connected in parallel. each pump lifts water from a common pump and discharges water to a common pipe to which the delivery pipes of each pump is connected, each pump is working against the same head.


Pumps in parallel.</td>
<td>4

3</td>
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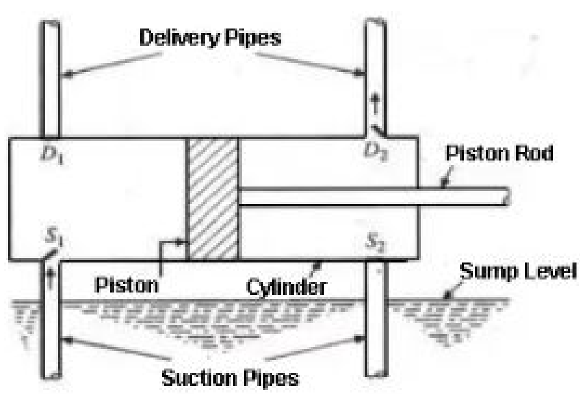
IX.	**A reciprocating pump is also known** a called a positive displacement pump. Because it discharges a definite quantity of liquid. It is often used where a small quantity of liquid is to be handled and where delivery pressure is quite significant. The following are the main **parts of the reciprocating pump.** 1. Cylinder 2. Suction Pipe 3. Delivery Pipe 4. Suction valve 5. Delivery valve 6. Piston and piston rod 7. Crank and connecting rod 8. Strainer 9. Air vessels In this, the water is acting on both sides of the piston as shown in the figure. Thus two suction pipes and two delivery pipes are required for a double-acting pump. When there is a suction stroke on one side of the piston, at the same time there is a delivery stroke on the other side of the piston. Hence for one complete revolution of the crank, there is two delivery stroke and the water is delivered to the pipes by the pump during these two delivery strokes  Double Acting Reciprocating Pump	4 3	7	7

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<td>X.</td>
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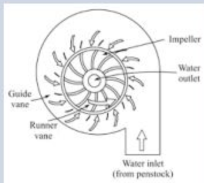
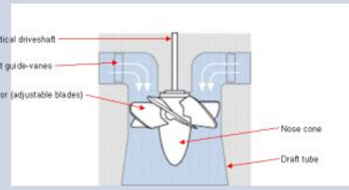
<table>
<tr><th>FRANCIS TURBINE</th><th>KAPLAN TURBINE</th></tr>
<tr><td>Radially inward or mixed flow turbine</td><td>Axial flow turbine</td></tr>
<tr><td>Medium head turbine</td><td>Low head turbine</td></tr>
<tr><td>Works under medium discharge</td><td>Works under very high discharge</td></tr>
<tr><td>Horizontal or vertical position shaft</td><td>Vertical position shaft</td></tr>
<tr><td>Runner vanes not adjustable</td><td>Runner vanes are adjustable</td></tr>
<tr><td>Larger no of runner vanes</td><td>Small no of runner vanes used</td></tr>
<tr><td>Ordinary governors is used</td><td>Heavy duty governors used</td></tr>
<tr><td>Centripetal type</td><td>Propeller type</td></tr>
<tr><td>
</td><td>
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<td>7*1</td>
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<td>XI.</td>
<td>A four-stroke or four-cycle engine is an internal combustion (IC) engine, in which four
individual cycle of operation is completed by two revolution of the crankshaft or four
individual strokes of piston

The four separate strokes are listed and described below ;

1. suction (Intake , induction) :- piston travels from top dead center (TDC) to bottom

dead center (BDC).Intake valve is Open and exhaust valve is closed. piston pulls air-
fuel mixture/fresh air into the combustion chamber by producing vacuum pressure in

cylinder through its downward motion.

2. Compression: Piston travels from BDC to TDC. In this stroke the piston compresses the
air-fuel mixture/fresh air. Both intake and exhaust valves must be closed.

3. Power (combustion , ignition) :- At the end of the compression stroke compressed air-
fuel mixture/fresh air is ignited by a spark plug/fuel injector. Piston travels from TDC

to BDC. This stroke produces mechanical work from the engine to turn the crankshaft.
Both valves are in closed position
4. Exhaust (outlet) :- The piston travels from B.D.C to T.D.C. The exhaust valve opened
and intake valve is closed. So that the unwanted exhaust gases ejected out from</td>
<td>4</td>
<td>7</td>
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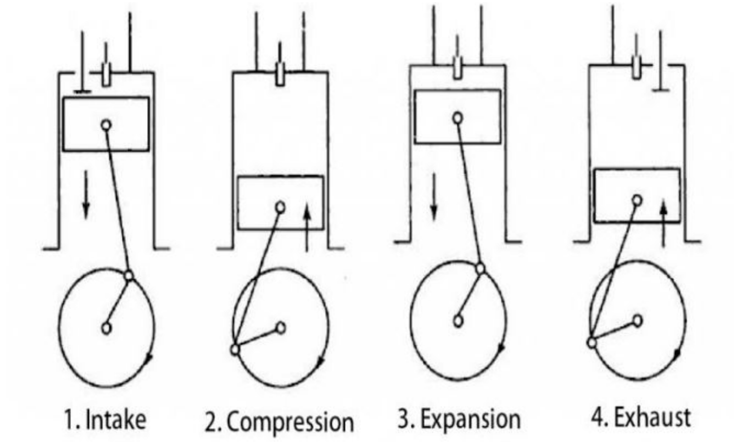
<tr>
<td></td>
<td>cylinder to atmosphere



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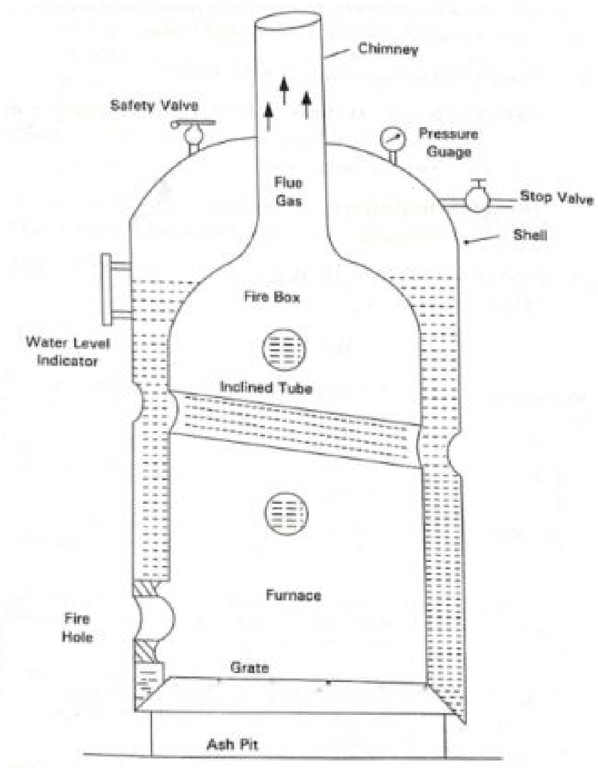
<td>XII.</td>
<td>

CONSTRUCTION

1. BOILER SHELL / DRUM / OUTER CASE – cylindrical in shape, which protect all internal components and
also stores water and steam

2. COMBUSTION CHAMBER – Fuel (charcoal/wood/coal...) burnt to produce heat in order to produce
steam

3. GRATE – it is a platform inside combustion chamber , upon which fuel is burned
4. FURNACE / FIRE BOX – its the space above grate amd below boiler shell , in which fuel is actually</td>
<td>3</td>
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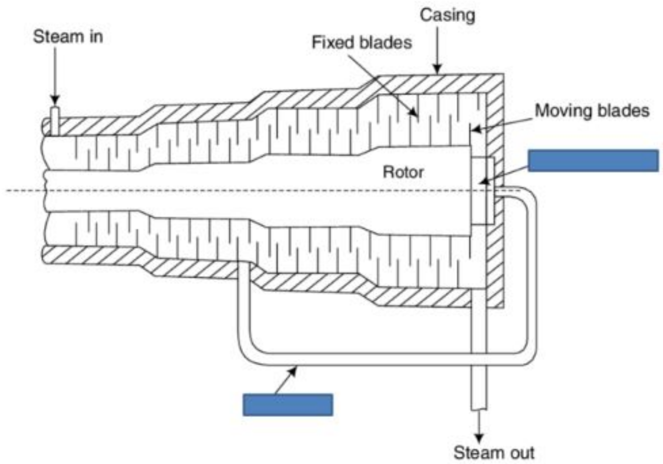
	burned 5. CHIMNEY – Passage through which flue gas / exhuast gases eject out 6. MOUNTINGS – devices mounted for proper functioning. A – water level indicators B – pressure guage C – safety valves etc..... 7. ACCESSORIES - devices used additionaly for boiler efficiency A – super heater B – feed pump etc............	4		
XIII.	 CONSTRUCTION 1. OUTER CASING 2. ROTOR 3. FIXED/GUIDE BLADES – fitted to casing 4. MOVING BLADES – fixed in rotor periphery WORKING • It’s a impulse reaction turbine • Superheated steam from boiler enters turine , passes through fixed & moving blades • Pressure decreases due to expansion of steam • Velocity increases in fixed blades & decreases in moving blades • Rotor rotates to produce mechanical work • Exhaust steam goes to condenser through draft tube	3 2 2	7	7

XIV.	**PETROL ENGINE**	7*1	7	7
	Petrol is used as fuel			
	Petrol price is higher than diesel			
	Works on OTTO CYCLE(Ie,Constant volume cycle)			
	Air and petrol are mixed together and enternto combustion chamber			
	Carburetor is used			
	Petrol is high volatile			
	Spark plug used for combustion			
	Spark plug is used			
	Lighter in weight(Compact engine)			
	Less starting problem			
	Low initial cost			
	Low maintenance cost			
	Low compression ratio			
	DIESEL ENGINE			
	Diesel is used as fuel			
	Diesel price is less			
	Works on diesel cycle(Ie , Constant pressure cycle)			
	Only air is entered into combustion chamber			
	Diesel is low volatile			
	Fuel injector is used to inject diesel fuel intocompressed air for combustion			
	Injector is used			
	Heavier in weight			
	Greater starting problem			
	High initial cost			
	High maintenance cost			
	High compression ratio			

BLUE PRINT

Mark Distribution

Module	Hr / Module	(hi / ∑Hi) * 123	TYPE OF QUESTIONS							
			PART A		PART B		PART C		TOTAL	
			No of Questions	Marks	No of Questions	Marks	No of Questions	Marks	No of Questions	Marks
I	10	28	2	2	2	6	2	14	6	22
II	11	31	2	2	2	6	2	14	6	22
III	11	31	2	2	3	9	4	28	9	39
IV	11	31	3	3	3	9	4	28	10	40
Total	43	121	9	9	10	30	12	84	31	123

Cognitive Level Wise Question Analysis

Mark Distribution

Cognitive Level	% Marks	Marks	TYPE OF QUESTIONS							
			PART A		PART B		PART C		TOTAL	
			No of Questions	Marks	No of Questions	Marks	No of Questions	Marks	No of Questions	Marks
R	7		9	9					9	9
U	68				7	21	9	63	16	84
A	25				3	9	3	21	6	30
Total	**100**		9	9	10	30	12	84	31	123