# Experimental and Neural Network Based Investigation of External Scavenged Two Stroke S.I. Engine

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Abstract: Two stroke spark ignition engines have high exhaust emissions and low brake thermal efficiency due to the short circuiting losses and incomplete combustion, which occur during idling and at part load operating conditions. To eliminate the short circuiting losses, new scavenging system has been developed. Here attempt is made to regulate the natural aspirated air for better fuel economy with increasing a speed and reduced emissions. In this project an attempt has been made to improve scavenging characteristic of two stroke engine. In the world, scientific studies increases day by day and computer programs facilitate the human's life. Scientists examine the human's brain's neural structure and they try to be model in the computer and they give the name of artificial neural network (ANN). The purpose of this study is to estimate fuel economy of an automobile engine by using ANN algorithm. Engine characteristics were simulated by using "Neuro Solution" software. This study deals with artificial neural network (ANN) modelling of a two stroke engines operated at different loads. Using some of the engine. To acquire data for training and testing the proposed ANN, two stroke engines operated at different loads. Using some of the experimental data for training, an ANN model based on feed forward neural network for the engine was developed. Then, the performance of the ANN predictions were measured by comparing the predictions with the experimental results which were not used in the training process. It observed that the ANN model can predict the engine characteristics quite well with correlation coefficients, with very small errors. This study shows that, as an alternative to classical modelling techniques, the ANN approach can be used to accurately predict the performance of internal combustion engines.

Keywords: Scavenging, Artificial neural network (ANN), BSFC, Short circuiting losses, Neuro solution, and Brake Power

#### 1. Introduction

#### 1.1 Background of Present Research:-

The subject inventions are related to the arrangement for facilitating the provision and the control of additional air, also referred to as scavenging air, to a 2 stroke internal combustion engine. More particularly, the inventions are referred to as a scavenging air transfer member that is mountable to the engine's carburetor, for facilitating the provision of scavenging air to the engine. From this point of view a further research is being carried by us, which can serve as an experiment practical for academic purpose also.

#### **1.2 Problem Identification**

The gas exchange or scavenging process is common to all internal combustion engines. Its function is to effect expulsion of the products of combustion from the engine cylinder and their replacement by fresh air charge in preparation for the next working cycle. In which the fresh charge coming from the transfer port directly goes out of the exhaust ports without removing any residual gas. This is a dead loss and its occurrence must be avoided. Here problem occurring is the power loss due to poor scavenging which may rise by the short circuiting process. Also it results in reduction in BSFC.

#### **1.3 Problem Formulation**

A detailed knowledge of the scavenging process becomes necessary during the development process, when the performance and in particular the emission output of twostroke engines needs to be qualified and evaluated. In order to improve the performance of I.C. Engine short-circuiting should be avoided. This is possible only when air provide a barrier for the fresh charges to be mixed with the residual gases. In this project an attempt is made to regulate the natural aspirated air for scavenging.

# 1.4 Introduction to Ann

ANN technique has been used for modeling the performance of various thermal systems recently; ANNs have been applied to estimate various performance parameters of internal combustion engines. This approach was used to predict the performance of two stroke engines. Several studies may be found in different areas of science making use of artificial neural-network. The ANN approach has been applied to predict the performance of various thermal systems. In this study of a work already in Neuro Solution program using data on fuel economy and speed of the engine.

The digital computer provided a rapid means of performing many calculations involving the artificial neural network (ANN) methods. Along with the development of high speed digital computers, the application of ANN approach could be progressed a very impressive rate. In recent years, this method has been applied various disciplines including automotive engineering, in forecasting of engine thermal characteristics for different working conditions. Some researchers studied this method to predict internal combustion engine characteristics.

# 2. Literature Review

The Literature review gives some background into the engines worked out in various industries. In the following literature review, a discussion of scavenging testing and comparison of various scavenging process And Artificial Neural Network has been implemented which makes this project more portable.

**2.1** M. AyazAfsar, pawar P., Dhaule P., Papinawar S. and Bobade P. carried out the research work on "Experimental investigation of direct air injection Scavenged Two Stroke S.I. Engine" according to them, 2 stroke engines have the advantage of low specific weight, simplicity of operation & less cost. However it has inherent drawbacks of poor scavenging & relatively high exhaust emissions. The concept of making hole in transfer port by direct injection of air stream is an attractive proposition for eliminating those drawbacks. In this paper an attempt has been made to study performance & emissions characteristics of a single cylinder direct injection using scavenging.

**2.2** Y. Ikeda, K.Y. Lee and R. mastumoto carried out a research on "Simultaneous Measurement of Velocity and Pressure in a Two Stroke Engine". A simultaneous measurement system of velocity and pressure to understand the flow characteristics induces by pressure difference and reduce cycle vibration with firing and monochroming condition.

**2.3** Hisatoshi Kinoshita and YuhMotoyamacarried out a research on "The Relationship Between Port Shape and Engine Performance for Two-Stroke Engines."The scavenging process in direct-injection two stroke research engines was examined by using an electromagnetically controlled poppet valve to sample the trapped charge.

**2.4** HakanSerhadSoyhan, Mehmet EmreKilic, BurakGokalp, ImdatTaymaz.carried out a research on "Performance Comparison Of Matlab And Neuro Solution Software On Estimation Of Fuel Economy By Using Artificial Neural Network" ANN technique has been used for modeling the performance of various thermal systems. In this study off a work already in Neuro Solution program using data on fuel economy and emission.

**2.5** T.Hari Prasad, Member, IACSIT, Dr.K.Hema Chandra Reddy and Dr.M.MuralidharaRao. carried out work on "Performance and Exhaust Emissions Analysis of a Diesel Engine Using Methyl Esters of Fish Oil with Artificial Neural Network Aid." This study deals with the performance of the ANN predictions were measured by comparing the predictions with the experimental results.

**2.6** Jerzy Kowalski,carried out a research on the "The Artificial Neural Network: A Tool For Nox Emission Estimation From Marine Engine." The paper presents the preliminary investigations of nitric oxides (NOx) estimation from marine two-stroke engines.

**Concluding Remark:** -The information present in this chapter is the first step in achieving the objective of this research.

# 3. Two Stroke Engine and External Scavenging Process

# **3.1 Introduction**

A two stroke engine is one which completes its cycle of operation in one revolution of the crankshaft or in two strokes of the piston. In this engine the functions of the intake and exhaust process of the four stroke engine are taken care of by the incoming fresh charge, which is compressed either in the crankcase or by means of a separate blower while the engine piston is near the bottom dead center. The engine piston needs only to compress the fresh charge and expand the products of combustion. Since a two stroke engine will have twice as many cycles per minute as a four stroke engine operating at the same speed and with the same numbers of cylinders, theoretically it will develop twice the power when operating at same mean effective pressure. As with the four stroke engine, the power output of this engine also depends upon the number of kilograms of air per minute available for combustion.



Figure 3.1: Working of Two Stroke Engine

In many two stroke engines the mechanical construction is greatly simplified by using the piston as a slide valve in conjunction with intake and exhaust ports cut in the side of the cylinder. Two stroke engines are most simple in construction as there are very few moving parts and but more difficult to analyze because of overlapping the inlet and exhaust. As there are only two strokes for performing four basic operations, the overlapping processes cannot be avoided. During the downward stroke, expansion is carried out during part of stroke and during remaining part of stroke; the exhaust and charging are carried out simultaneously. This process is also continued during the upward motion of the piston for part of stroke, and for remaining part of stroke, the compression is carried out.

# 3.2 Two Stroke Engines

# 3.2.1 Advantages

- Two-stroke engines do not have valves, simplifying their construction.
- Two-stroke engines fire once every revolution (fourstroke engines fire once every other revolution). This gives two-stroke engines a significant power boost.

- Two-stroke engines are lighter, and cost less to manufacture.
- Two-stroke engines have the potential for about twice the power in the same size because there are twice as many power strokes per revolution.

#### **3.2.2 Limitations**

- Two-stroke engines don't live as long as four-stroke engines. The lack of a dedicated lubrication system means that the parts of a two-stroke engine wear-out faster.
- Two-stroke engines require a mix of oil in with the gas to lubricate the crankshaft, connecting rod and cylinder walls.
- Two-stroke engines do not use fuel efficiently, yielding fewer miles per gallon.
- Two-stroke engines produce more pollution.

#### **3.3 Scavenging Process**

The method of removing the exhaust gases with the help of fresh charge in petrol engine or byl the inlet air in diesel engine is known as scavenging. This is carried out during the overlapping of inlet and exhaust ports. The basic requirement of an ideal scavenging system is to remove exhaust gases without any loss of fresh charge on air. Such ideal system in practice is impossible but utmost care should be taken to reduce the loss to minimum. The best air path is achieved through scavenging in which mixture on air is admitted at one end of the cylinder and exhaust gases are discharged from the other end.



Figure 3.2: Working of Scavenging Process

At the end of the expansion stroke, the combustion chambers of a two stroke engine is left full of products of combustion. This is because, unlike four stroke engines, there is no exhaust stroke available to clear the cylinder of burnt gases. The process of clearing the cylinder, after the expansion stroke, is called scavenging process. This must be completed in a very short duration available between the ends of the expansion stroke and start of the charging process. The efficiency of a two stroke engine depends to a great degree on the effectiveness of the scavenging process, since bad scavenging gives a low mean indicated pressure and hence. results in a high weight and high cost per BHP for the engine. With insufficient scavenging the amount of oxygen available is low so that the consequent incomplete combustion results in higher specific fuel consumption. Not only that, the lubricating oil becomes more contaminated, so that, it's lubricating qualities are reduced and results in increased wear of piston and cylinder liners. Poor scavenging also leads to higher mean temperatures and greater heat stress on the cylinders walls.

Thus it goes without saying that every improvement in the scavenging leads to improvement in engine and its efficiency in several directions and hence, a detailed study of scavenging process and different scavenging systems is worthwhile. The scavenging process is the replacement of the products of combustion in the cylinder from the previous power stroke with fresh air charge to be burnt in the next cycle. I the absence of an exhaust stroke in every revolution of the crankshaft, this gas exchange process for a two stroke engine must take place in it's entirely at the lower position of the piston travel.

When the inlet port opens the gases expanding in the main cylinder tend to escape from it and to pre-discharge into the scavenge air manifold. This process, called preblow down, ends when the exhaust port opens. As soon as the exhaust port opens, the gases existing in the cylinder at the end of the expansion stroke discharge spontaneously into the exhaust manifold and the pressure of the main cylinder drops to a valve lower than that existing in the scavenge air manifold. This process, called blow down, terminates at the moment the gas pressure inside the cylinder attains a valve slightly lower than the air pressure inside the scavenge manifold. During the third phase, called scavenging which starts at the moment the spontaneous exhaust gases from the cylinder terminates and ends at the moment the exhaust ports are closed; the scavenge air sweeps out all residual gases remaining in the main cylinder at the end of the spontaneous exhaust and replaces them as completely as possible with fresh charge. After scavenging is complete the fresh charge continues to flow till the scavenge ports are open and the pressure in the cylinder rises.

#### 3.4 Perfect Scavenging

Ideally fresh air in C.I. engine should remain separated from the burned gases with respect to mass flow and heat flow during the scavenging process. The fresh air is pumped in the cylinder through inlet ports and the burned gases are pushed out off cylinder through exhaust ports by the fresh air as shown in fig. During this process it is assumed that there is no mixing of fresh air and gases as long as any products remain in the cylinder. The flow through exhaust port is considered to be burned gases only. When both ports are closed, the cylinder volume contains only fresh air. This type of scavenging is known as perfect scavenging.



Figure 3.3: Perfect Scavenging

#### 3.5 Short circuiting

The opposite extreme to the ideal scavenging process is the case of short circuiting in which the fresh charge coming from the scavenge manifold directly goes out of the exhaust International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

ports without removing any residual gases. This is a dead loss and its occurrence must be avoided. The actual scavenging process is neither perfect scavenging nor mixing and little short circuiting. Therefore, the prediction of the actual scavenging in two stroke engine is very difficult.

#### **3.6 Scavenging Methods**

Classification of two stroke engines is based on the air flow.

#### 3.6.1 cross-scavenging

The flow in this system is shown in fig.



Figure 3.4: Cross Flow Scavenging

The cross scavenging system is probably the most common, particularly in petrol engine. There is usually a deflector head type piston. The object is being to avoid short circuiting by directing the mixture flow. The deflector head is troublesome from heat flow consideration, because off the metal thickness required and difficulty in cooling it. The combustion space produced is not necessarily the best, particularly for oil engines. As alternative construction is angling of the inlet ports towards top off cylinder, to direct the air flow. This arrangement is generally used in crankcase scavenging system.

This system is not very effective and the BMEP generally does not exceed 3 bars in petrol engine. But its simplicity in design and construction and low cost are more important than specific output, therefore, it is commonly used with two-wheels of low capacity system. The port timing diagram is as shown in fig.



Figure 3.5: Port Timing Diagram

#### 3.6.2 Loop Scavenging System

There are three principle variation of a loop scavenging system as shown in fig.



Figure 3.6: Basic Type of Loop Scavenging System

#### 3.6.3Tangential Loop Scavenging System

The arrangement is shown in fig. In this system, air is directed upwards through an inclined inlet ports in two sides of the cylinder. The exhaust, leaving through exhaust ports, placed between the two inlet ports. It provides much better scavenging than the simple loop system and this is the main advantage of this system.



Figure 3.7: Tangential Loop Scavenging System

#### 3.6.4 Uniflow Scavenging System

Uniflow scavenging is so called because the air and exhaust gases do not change direction of flow passing through the cylinder. Therefore, the possibility of short circuiting and mixing are considerably reduced. The air inlet, controlled by the piston may be at the lower end of the cylinder and exhaust outlet in the cylinder cover may be controlled by poppet valve which is mechanically operated by the cam shaft.



Fig 3.8: Uniflow Scavenging System

An alternative system to the system mentioned above is shown in fig. In this system inlet and exhaust ports are controlled by separate pistons. These pistons may be driven by separate crankshaft. The major advantage of this system is reduced mixing of fresh charge and exhaust gases compared with all previous scavenging systems.

**Concluding Remark:** - In this chapter we have the study of various types of scavenging process and importance of two stroke engines.

# 4. Artificial Neural Network (ANN)

An artificial neural network (ANN) as a computing system is made up of number of simple, and highly interconnected processing elements, which processes information by its dynamic state response to external inputs. In recent times the study of ANN models is gaining rapid and increasing importance because of their potential to offer solution to some of the problems which have hitherto been intractable by standard serial computers in the areas of computer science and artificial intelligence. Neural networks are better suited for achieving human-like performance in the field such as speech processing, image recognition, machine vision, robotic control, etc.



Figure 4.1: Schematic off feed forward neural network

Fig. shows a schematic of generic feed forward network which is the most commonly used ANN model. Processing elements in an ANN are also known as neurons. These neurons are interconnected by means of information channels called interconnections. Each neuron can have multiple inputs; while there can be only one output (fig. below). Inputs to neuron could be external stimuli on could be from output of the other neurons. Copies of the single output that comes from a neuron could be input to many other neurons in the network. It is also possible that one of the copies of the neuron's output could be input to itself as a feedback. There is connection strength, synapses, on weight associated with each connection, when the weighted sum of the inputs to the neuron exceed.



Figure 4.2:

Neural networks have been trained to perform complex function in various fields of application including pattern recognition, identification, classification, speech, and vision and control systems. Today neural networks can be trained to solve problems that are difficult for conventional computers or human beings. Throughout the toolbox emphasis is placed on neural network paradigms that build up to or are themselves used in engineering, financial and other practical applications. A neural network also known as a parallel distributed processing network, it consist of interconnected processing elements called nodes or neurons that work together to produce an output function. The output of a neural network relies on the cooperation of the individual neurons within the network to operate. Processing of information by neural networks is characteristically done in parallel rather than in series as in earlier binary computers or von Neumann machines. Since it relies on its member neurons collectively to perform its overall functions even some of the neurons are not functioning.

Neural network theory is sometimes used to refer to a branch of computational science that uses neural networks a model to either simulate or analyze complex phenomena and study the principles of operation of neural networks analytically. Traditionally, the term neural network has been used to refer to a network of biological neurons. Biological neurons that is connected or functionally-related in the peripheral nervous system on central nervous system. In the field neuroscience, they are often identified as groups of neurons that perform a specific physiological function in laboratory analysis. Artificial neural networks are made up of inter connecting artificial neurons designed to a model some properties of biological neural networks.

In our project, reading off two strokes S.I. Engine at various parameters on varying load with normal engine and with scavenging system taken as a input of ANN (Neuro solution software) and get output in terms of brake power and in terms of BSFC.



Figure 4.3: Flow chart

# 5. Design and Calculations

# 5.1 Design of scavenging port:-

Discharge of engine Q = Cd x AxV

 $A = \frac{\pi}{4}D^{2}$   $V = \sqrt{2g ha}$   $ha = \frac{\rho w}{\rho a} \times hw$   $= \frac{1000}{1.127} \times 16 \times 10^{-2}$  ha = 141.96 m of air  $V = \sqrt{2 \times 9.81 \times 141.96}$  V = 52.77 m/sec  $Q = 150 \times 10^{-6} \times \frac{5500}{60} \times 0.2$   $Q = 2.75 \times 10^{-3} m^{3}/sec$   $Q = Cd \times A \times V$   $2.75 \times 10^{-3} = \frac{\pi}{4} \times D^{2} \times 52.77 \times 0.6$  D = 0.0105 m = 10.5 mmConsider  $D \approx 10 \text{ mm}$ 

#### 5.2 Design of Dynamometer

B.P =  $2\pi NT/60$ The maximum brake power achieved is 6KW Maximum Speed = 5500 rpm. Torque = (F × R) Where, F= spring balance force in Newton.  $6 = 2 \pi (5500) (F*0.115)/60$ F = 90.58 N F = 9.23 Kg.

#### 5.3 Measurement and Testing

In order to validate the improvement we have to measure the various parameters using the various equipment's and by conducting the various tests on the engine. Also we have to compare the engine in terms of its output and efficiency. Measurement of various Basic parameters

- 1)Fuel consumption
- 2)Brake power
- 3)Speed of engine

# 5.4 Experimental Setup

The experimental setup to study the direct air injection scavenged engine is as shown in fig.



Figure 5.1: Experimental Setup

Control Unit, Air box, Carburetor, Fuel Meter, Crankcase, Engine, Dynamometer, Tachometer, Spring balance, Air box for scavenged air, Manometer, Burrete, Exhaust gas analyzer, Direct air injection.



**Actual Setup** 

A rope brake dynamometer which consists of rope, two spring balances used for loading the engine to measure brake power. The air flow is measured with the help of Air box, which pressure is measured with the help of U-Tube manometer, mounted itself on the air box. The fuel measurement is taken with the help of Burette which is calibrated. A tachometer along with digital rpm indicator is used to measure the speed of the engine.

 Table 5.1: Engine Specification

Technical Specifications of Novel Engine								
1.00	Performance							
Peak power	8.0 hp at 5500 rpm	Highest power						
		amongst 2-stroke						
		scooters						
Peak torque	1.35 Kgm at 3500	Instantaneous pick-up						
	rpm							
	Engine							
Туре	5-port single	Advanced engine for						
	cylinder, 2-stroke	superior performance						
	with reed valve							
	induction							
Transmission	4-speed gear box	Smooth easy shifting						
Clutch	Wet multi-disc type							
Operating cycle	Two-stroke spark ignition, 150 cc engine							
Compression ratio	8.5							
Bore	0.057 m							
Stroke/bore ratio	0.94							
Max rated BMEP	3 bar							
Wt/power ratio	5.	5-2.5						
Appr. Best Bsfc	350 m/kw hr)							

# **5.4Test Procedure**

- 1. Start the engine by cranking the kick provided for cranking.
- 2. After engine is started burette is full by fuel.
- 3. Adjust the speed of the engine with the help of tachometer.
- 4. Adjust the load as per requirement.
- 5. Measure fuel consumption for 60 sec with the help of stopwatch.
- 6. Open the scavenging knob for different opening.
- 7. Note down speed of engine by the tachometer.
- 8. Note down the fuel consumption for scavenging system.

#### **Concluding Remark: -**

Here performance evaluation for the conventional Two Stroke SI Engine by taking the observations reading of various parameters for both with and without direct air scavenging system.

# 6. Performance and Evaluation

**Table 6.1:** Performance Evaluation of Various Parameters

 on Varying Load with Normal Engine and with Scavenging

Load = 00 kg

82 50	liped		Speed Ar fire 52 for 52 for		39	BOC			
	Nend	formpro gm	shared	shared	kg for	kg br	Nettal	Scarenging by	Normal Agiles for
1	1500	1810	25	1.70	1.14		1		1
2	134	2119	- 54	1.51	1.00	4		۰.	8
3	1390	2619	- 11	6.79	1.01	1			
.4	1500	3479	330	1.31	1.04	1		8	
1	1750	2010	25	1.94	134	1	÷ 1	4	1
	1750	289	- 24	1.00	1.12	- 1		-4	1
7	1758	2810	- 18	1.96	137			4	1
	179	3880	3.00	1.14	1.31	1			
	3990	2210	35	122	1.04				
10	3000	349	30	122	1,11	4			1
11	3000	2920	25	1.22	\$.22	1			
11	2000	4291	396	1.27	1.11	1		4	1

# **Table 6.2:**-

8		Speed	Ar for	Mitt	Mitr		12	/	2728
No	Nemi	Screeping	quint	need	to white	Nend	Strengtag kn	Nená	(contrat)
	- 24	. dar		1gh	kg for	la.	1	lipite.ir	( birk
1	1500	1940	25	0.83	6.92	635	1.8	Sil	12.42
1	1500	2060	- 50	0.83	1.00	08	14	1.9.	210
3	1500	2050	75	0.83	1.05	633	1.67	237	1.91
4	1500	3470	300	0.43	119 /	6.35	691	. 28	134
5	1750	1670	25	1.00	134	141	14 /	248	2.54
6	1750	2190	- 50	1.00	151	840	6.51	246	2.31
1	1750	2960	15	1.00	/122	141	9.69	246	14/
1	1750	4010	100	1.00	/ 138	14	/04	246	15
Ø.,	3000	2130	N	1.18	122	147	0.50	2.51	24
10	200	2360	55	1.18	1.22	6.47	0.45	2.51	2.0
11	2000	3130	18	111	1.31	147	13	2.51	1.79
12	2000	4120	100	111	1.31	6.47	147	2.91	1.35

#### **Table 6.3: -**Load = 04 kg

<u>\$</u>	Speed		As for	Mite	Mar	2-	32	Batt		
Se.	Normal	Scivinging	dentit	sonal	spinist	Send	Schuldent pa	Nona	Sarenging	
	dar (	70		98 pr	19/4	1.0	11	igin fr	plan.p	
1	1500	1680	25	0.87	/283	05	19	124	118	
2	1500	2070	56	0.87	191	0.70	60	1.14 <	18	
3	1500	2990	75	0.87	1.00	1/22	19	134	121	
4	1500	3960	190	1.17	1.16	1.7	1.0	1.38	8.9	
5	1790	186	2	1.05	1.09	142	111	-esp	5 #2	
٥.	1750	2250	59	145	114	1.62	128	129	1191	
1	1730	2990	14	1.05	1.14	8.82	1.38	13	1 25	
ł	1790	4060	100	1.05	1.18	1.12	130	1.28	-44	
۶.	2000	2250	3	1.12	1.27	.0,94	1.05	1.39	1.30	
10	2900	2535	拔	1.22	1.27	0.94	118	1.39	147	
11	2000	3455	75	1.22	131	0.94	162	139	8.0	
12	3900	4220	300	1.22	131	0.94	1.99	1.39	1.6	

#### **Table 6.4:-**Load = 06 kg

81. 30	Speed		At Sev	Mite	Mite		22	BSFC	
	Normal spin	karanjaj ga	dunt	denti n	ng sensi igtr	t ight i	Normal Inc	Scientiful for	Sirmi igin b
1	1590	1799	25	0.92	194	138	1.22	0.86	0.78
2	1500	2116	55	0.92	198	116	1.4	0.95	0.94
)	1500	3910	73	1.82	1.00	1.06	2.07	0.95	04
4	1599	.3990	100	0.92	108	110	2.62	0.88	0.38
5	1750	1970	25	1.09	134	1.24	1.94	0.17	6.82
1	1790	2310	59	1.09	114	1,24	1.98	0.87	0.67
1	1750	3/40	75	109	1.0	124	215	0.07	6.54
1	1750	414	100	1.09	1.22	1.24	191	0.02	0.41
ş.,	2000	2510	25	1.22	131	141	1.67	0.16	0.81
10	2000	2650	35	122	127	141	1.86	0.86	163
11	2000	3585	75	122	134	1.41	2.4	0.86	6.52
12	2000	400	190	122	135	141	18	0.95	0.41

#### **Table 6.5:-**Load = 08 kg

9		ipent	At fav	Mite	Miter	-	52		BERC
No.	Normal spin	da Zavatist	dant	opning annul kg/m	xarenging kg/te	Nemal	Scienting by	Nernal Agike Ar	Scorenging Agilevite
1	1500	1780	8	632	1.00	141	1.68	16	0.60
2	199-	2190	9	1.42	145	[4]	2.06	1.65	0.50
3	1500	387	- 72	0.42	1.09	141	2.62	1.62	0.38
.17	" 150 g.	4000	10	0.80	1.14	141	3.88	1.65	0.29
9	1175	7.34	25	1.09	1.18	145	1.87	1.65	6.62
1	1750	6.64-7	30.55	TN.	1.22	1.65	225	1.66	0.54
3	179	310 0	15	1.09	121	1.65	2.62	1.00	0.41
1	1758	43	100	1.09	122	1.65	2.54	0.56	0.30
1	200	2340	25	1.18	ोइर	1.89	225	24.0	6.56
à	200	210	18	118	12/	1.89	2.58	1.62	0.49
11	200		À	1.18	137	1.85	3.41	0.62	0.38
12	3000	4340	305	1.18	1.35	1.89	434	142	0.32

**Concluding Remark:** -in this chapter performance evaluation of various parameters and reading taken out for both with and without novel scavenging system.

# 7. Results and Discussion

From the overall experimental setup is has revealed the effect of NOVEL ENGINE improves the engine performance. From results it is almost clear that with NOVEL 2stroke SI engine gives more power for same fuel consumed as compared to with crankcase scavenged engine.

A neural network based modeling approach is introduced to characteristic of i.c. engine. A model based optimization method is used to identify optimal engine calibration parameter So that fuel efficiency can be achieved.

# 8. Conclusion

The following are the important conclusions based on the experimental analysis of the NOVEL scavenged two-stroke spark ignition engine.

- 1) Improvement in BP up to 0.35% and more complete combustion of the NOVEL engine were observed as compares to the conventional engine.
- 2) It is found that the BSFC is decreased by about 0.3%. This is due short-circuiting losses are completely avoided.
- 3) The speed of the engine is increase up to 0.4% which is the area for future research.
- 4) The proposed of ANN can be used for obtained experimental performance of engine with less time.

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