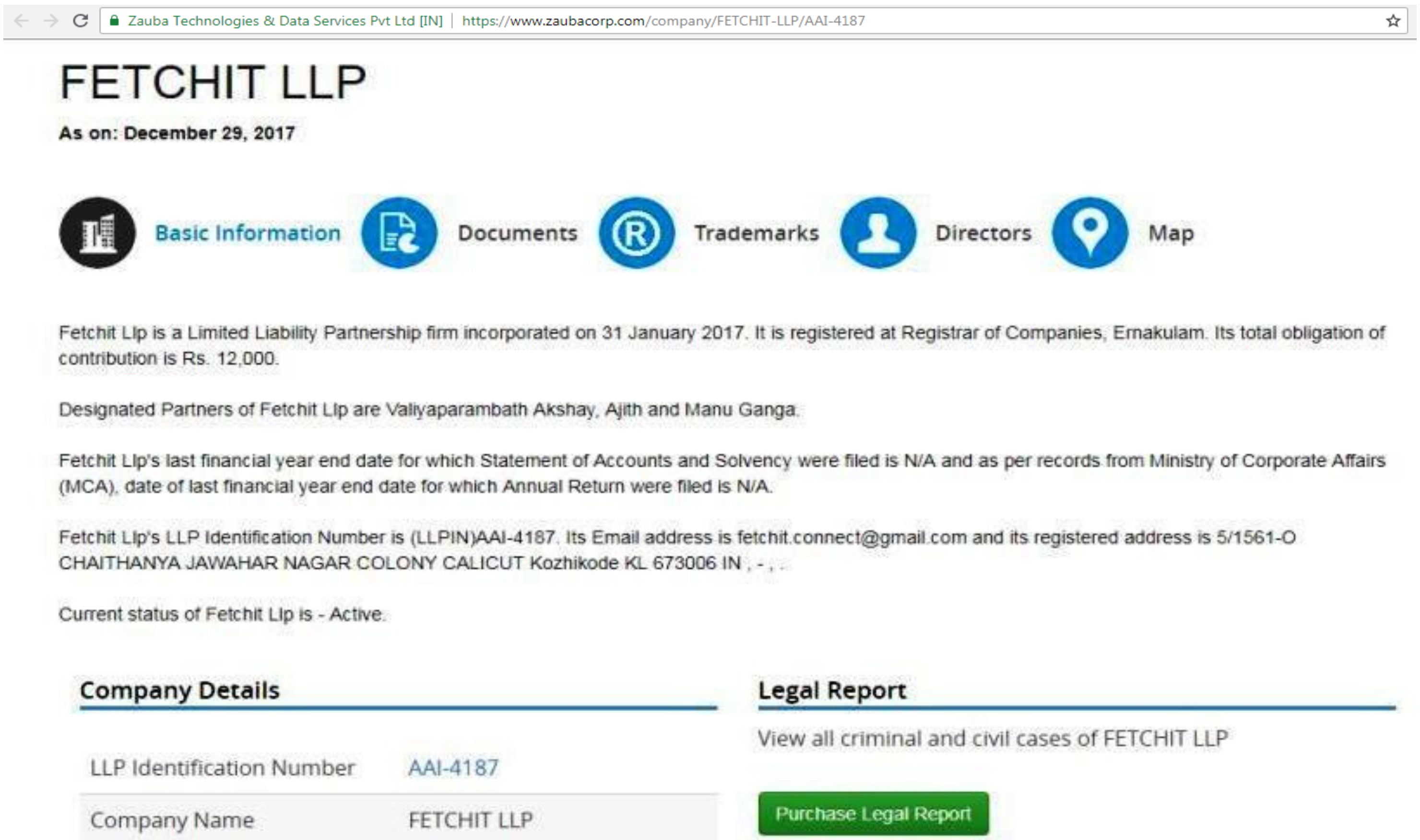
1. STARTUPS

Fetchit LLP company Description

Fetchit is a smart gadget designed and developed by Fetchit LLP. The gadget is currently under development and is in "Prototype" Stage.

ABOUT US

Fetchit LLP helps in real time tracking of objects and personal in a confined space. We have both B2B and B2C ends. Our consumer product is a luxurious gadget based on tracking any objects such as keys, wallet etc. The objects can be tracked on your phone or tablet devices using a dedicated app. And on the business to business phase, fetchit can be used for real time track any item or personal in a limited area like office space, parks, yard etc.



Zauba Technologies & Data Services Pvt Ltd [IN] | https://www.zaubacorp.com/company/FETCHIT-LLP/AAI-4187

FETCHIT LLP

As on: December 29, 2017

Basic Information | Documents | Trademarks | Directors | Map

Fetchit Llp is a Limited Liability Partnership firm incorporated on 31 January 2017. It is registered at Registrar of Companies, Ernakulam. Its total obligation of contribution is Rs. 12,000.

Designated Partners of Fetchit Llp are Valiyaparambath Akshay, Ajith and Manu Ganga.

Fetchit Llp's last financial year end date for which Statement of Accounts and Solvency were filed is N/A and as per records from Ministry of Corporate Affairs (MCA), date of last financial year end date for which Annual Return were filed is N/A.

Fetchit Llp's LLP Identification Number is (LLPIN)AAI-4187. Its Email address is fetchit.connect@gmail.com and its registered address is 5/1561-O CHAITHANYA JAWAHAR NAGAR COLONY CALICUT Kozhikode KL 673006 IN , - , .

Current status of Fetchit Llp is - Active.

Company Details

LLP Identification Number	AAI-4187
Company Name	FETCHIT LLP

Legal Report

View all criminal and civil cases of FETCHIT LLP

Purchase Legal Report

Company Status	Active
RoC	RoC-Ernakulam
Main division of business activity to be carried out in India	Manufacture of electrical machinery and apparatus N.E.C.
Description of main division	Manufacture of electrical machinery and apparatus N.E.C.
Number Of Partners	0
Number of Designated Partners	3
Date of Incorporation	31 January 2017
Age of Company	1 years, 4 month, 25 days

Financial Report

Balance Sheet	
Paid-up Capital	🔒
Reserves & Surplus	🔒
Long Term Borrowings	🔒
Short Term Borrowings	🔒
Trade Payables	🔒
Current Investments	🔒
Inventories	🔒
Trade Receivables	🔒
Cash and Bank Balances	🔒

Director Details

DIN	Director Name	Designation	Appointment Date	
07679504	VALIYAPARAMBATH AKSHAY	Designated Partner	31 January 2017	View other directorships
07679523	AJITH	Designated Partner	31 January 2017	View other directorships
07679525	MANU GANGA	Designated Partner	31 January 2017	View other directorships

ASKResults - Android App

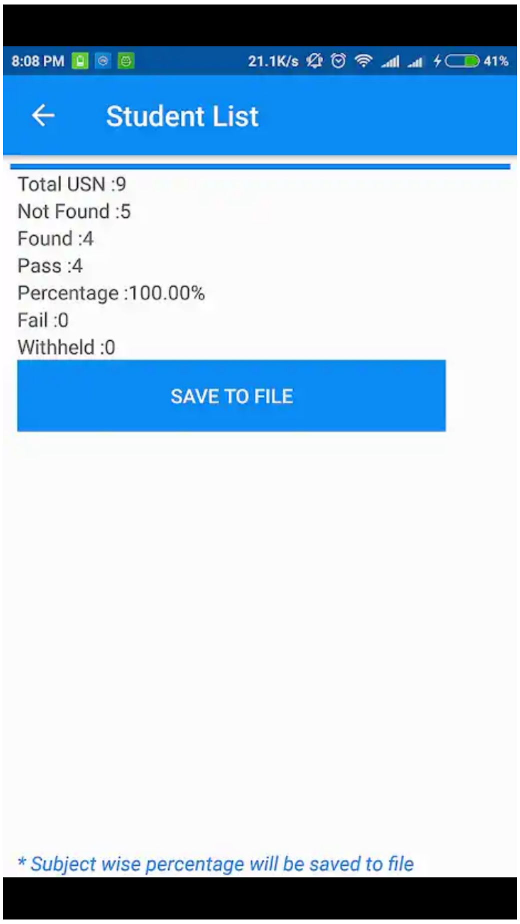
ASKResults addon is helpful for viewing the results directly without visiting VTU website. It gives all the information provided in VTU website like Sem results, Reval results, Backlog results and Result announcements for each sem. It is very easy to use and works faster. Advanced Search is added to check whole class results by giving the range and also saving option is provided for both individual and advance searched result.

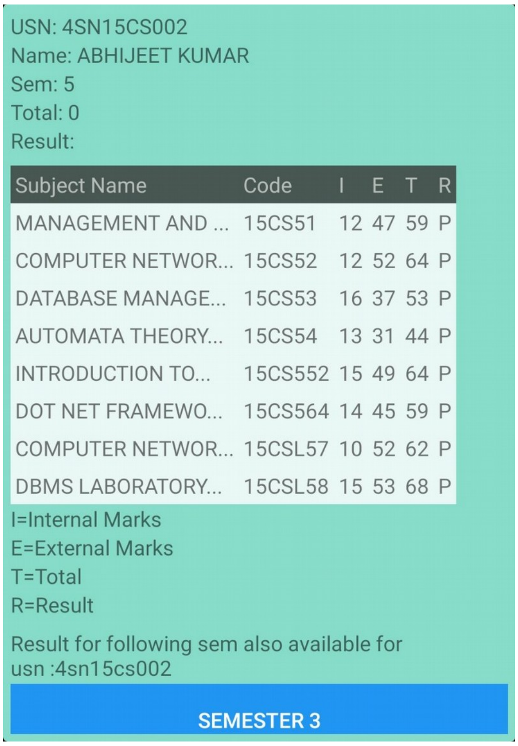
FEATURES

- Quick and faster VTU results.
- CBCS and Non-CBCS result search
- Revaluation results search
- Sharing of individual results.
- Searching and savin g of bulk /series of Usn Results.
- File import supports .txt, .csv, .xsl files.
- Share and delete saved files.
- Output files are saved in .csv format.

Link to access the App:
https://play.google.com/store/apps/details?id=com.askresult.askresult

Developed by:
Alwyn Edison Mendonca
Shashidhara
Gopika G(4SN13CS040)
K K Gayathri Ramesh(4SN13CS044)
Kripa M L(4SN13CS048)
Likitha U B(4SN13CS051)





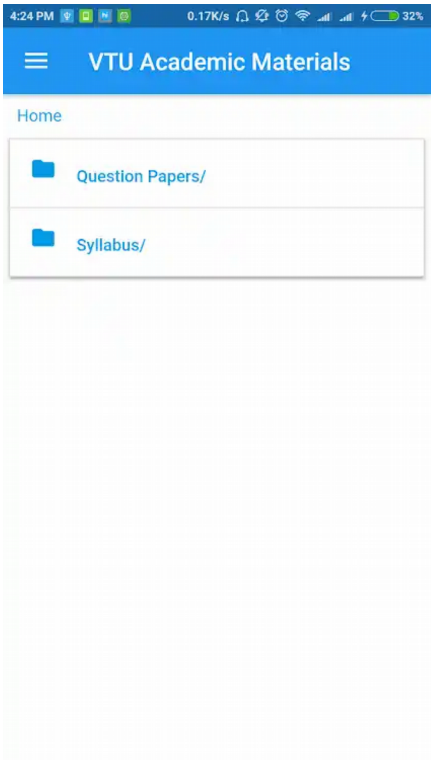
USN: 4SN15CS002
Name: ABHIJEET KUMAR
Sem: 5
Total: 0
Result:

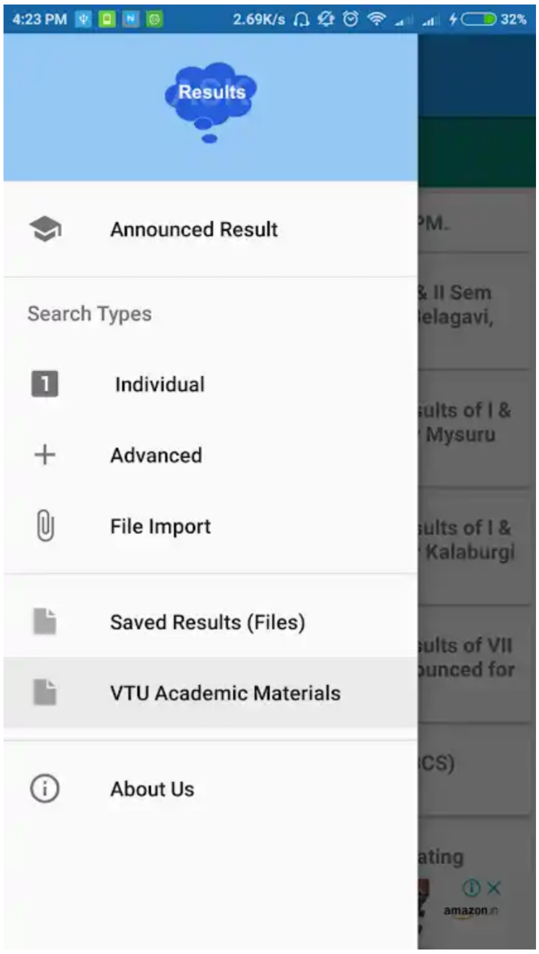
Subject Name	Code	I	E	T	R
MANAGEMENT AND ...	15CS51	12	47	59	P
COMPUTER NETWOR...	15CS52	12	52	64	P
DATABASE MANAGE...	15CS53	16	37	53	P
AUTOMATA THEORY...	15CS54	13	31	44	P
INTRODUCTION TO...	15CS552	15	49	64	P
DOT NET FRAMEWO...	15CS564	14	45	59	P
COMPUTER NETWOR...	15CSL57	10	52	62	P
DBMS LABORATORY...	15CSL58	15	53	68	P

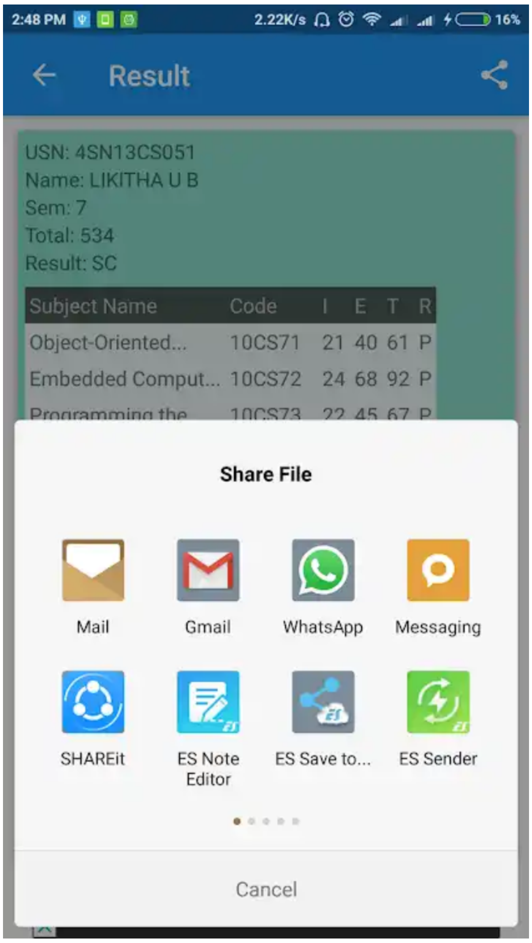
I=Internal Marks
E=External Marks
T=Total
R=Result

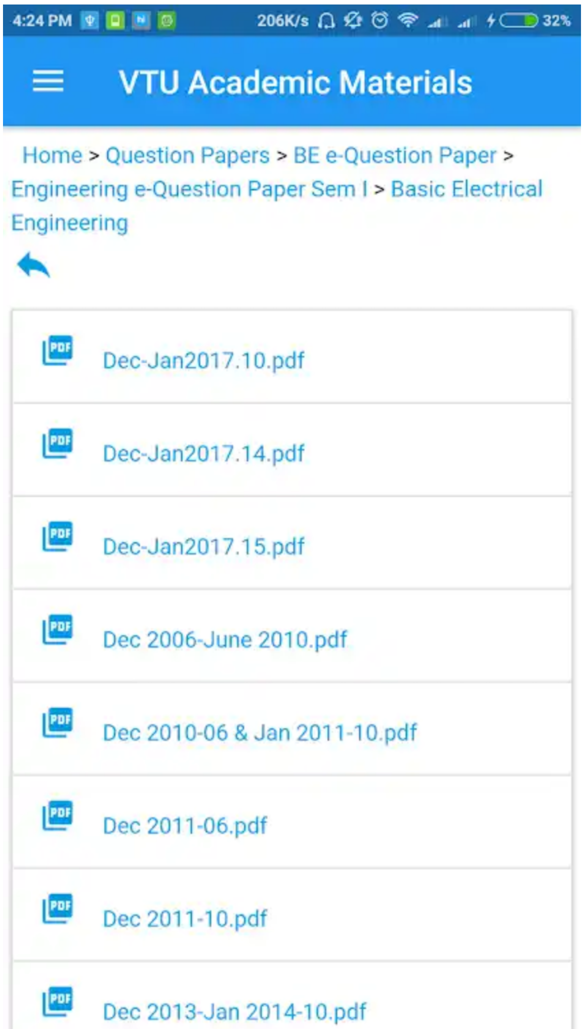
Result for following sem also available for usn :4sn15cs002

SEMESTER 3

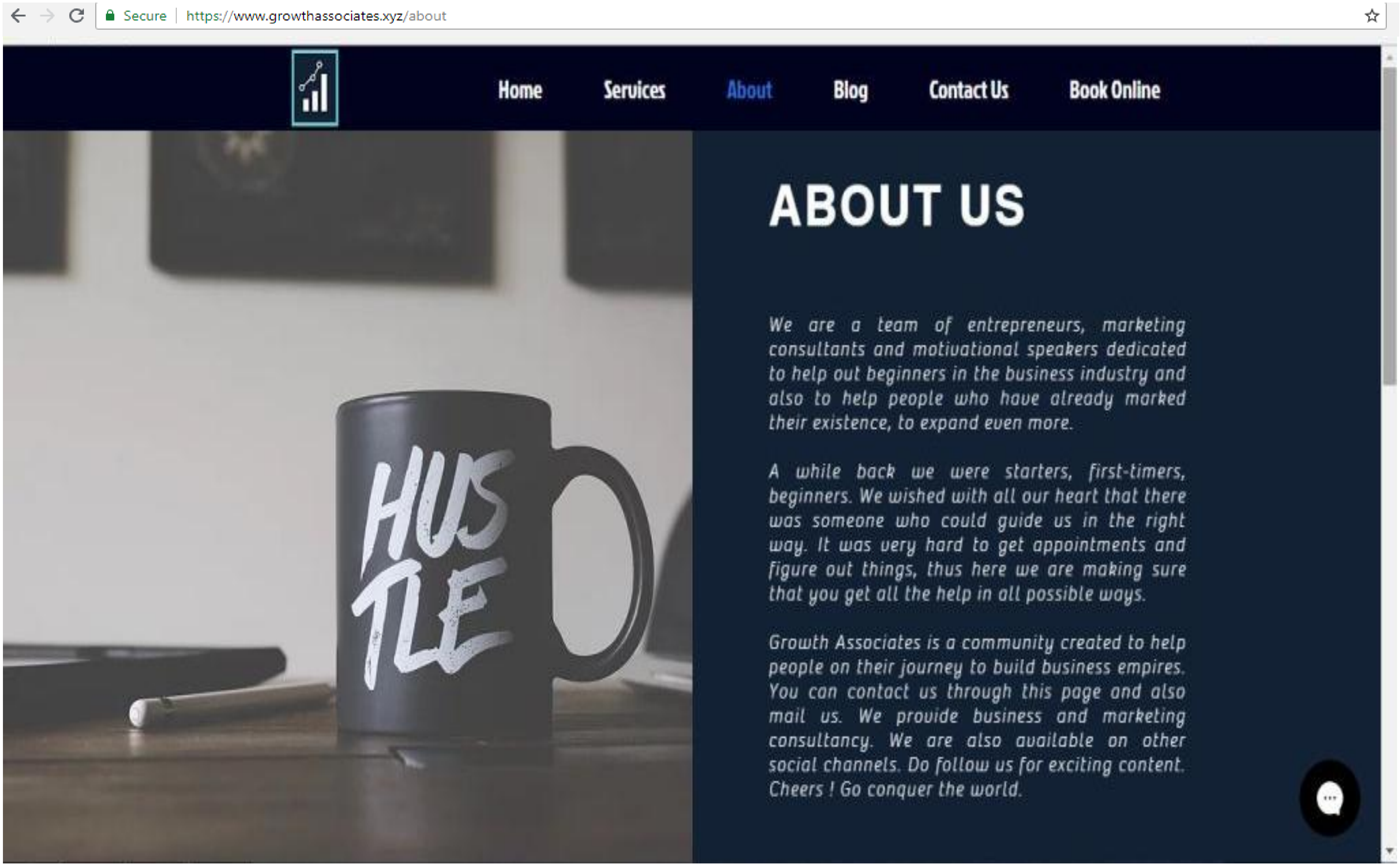





2:48 PM
2.22K/s
16%
Result
USN: 4SN13CS051
Name: LIKITHA U B
Sem: 7
Total: 534
Result: SC
Subject Name Code I E T R
Object-Oriented... 10CS71 21 40 61 P
Embedded Comput... 10CS72 24 68 92 P
Share File
Mail
Gmail
WhatsApp
Messaging
SHAREit
ES Note Editor
ES Save to...
ES Sender
Cancel


4:24 PM
206K/s
32%
VTU Academic Materials
Home > Question Papers > BE e-Question Paper > Engineering e-Question Paper Sem I > Basic Electrical Engineering
Dec-Jan2017.10.pdf
Dec-Jan2017.14.pdf
Dec-Jan2017.15.pdf
Dec 2006-June 2010.pdf
Dec 2010-06 & Jan 2011-10.pdf
Dec 2011-06.pdf
Dec 2011-10.pdf
Dec 2013-Jan 2014-10.pdf

Growth Associates Company Description



Secure | https://www.growthassociates.xyz/about

Meet The Team

Manu Nambiar

Akshay V

Ajith V M

in in in

Growth Associates

contact@growthassociates.xyz

Top

3D PRINTING MACHINE

The final year student of Mechanical Engineering Department Mr. Sethuraj has developed Rapid Prototyping Machine, which can produce any type of products with higher efficiency and low cost. Technique used in this machine is Fused Deposition Modeling (FDM). He used this machine to produce all components of his final year project "Unmanned Aerial Vehicle" for which he has applied for patent.

The project is financially supported by the department and is used to train the students in the field of RPD

Agreement

Between

Srinivas Institute of Technology

and

Akar training & consultancy LLP

for Training students on

Qualification Pack of SSC NASSCOM

This Agreement has been made and agreed upon between the Parties mentioned below, signed on the 16th day of the month of June, year 2015

BETWEEN

Akar training & consultancy LLP represented by the **Kiran Hebbar** (hereinafter called "First Party"), represented by its Designated Partner which expression shall, where the context so admits, be deemed to include its successors, executors and administrators of the ONE PART

AND

Srinivas Institute of Technology represented by the **Dr. Shrinivasa Mayya D**, Principal (hereinafter referred to as "Second Party") which expression shall unless repugnant to the context or meaning thereof, include its successor in office, legal representatives and permitted assigns of the SECOND PART

Background and Purpose

Akar training & consultancy LLP, Training partner for SSC NASSCOM, SIEMENS PLM and SIEMENS Motion Drive gave a proposal to train Mechanical stream graduates on **Qualification Pack QP 4201: Product Design Engineer – Mechanical.** The proposal has been accepted and the training will start from July 2015.

The agreement is for a period of 3 years from the date of signing and on mutual agreement can be extended for another term of 3 years.

***

5. Any other matter not included in this Agreement which is necessary for the smooth functioning of the mission/project/ scheme shall be finalized between the Second Party and the First Party on mutually agreeable terms and conditions.

6. The Agreement or any part thereof may be amended at any time during its tenure only by the consent, in writing, of the Parties concerned.

Both the Parties have set their hand in the presence of the witness on the 16th day of June, year 2015, as mentioned above.

For AKAR TRAINING & CONSULTANCY LLP

Designated Partner

Name: CA. A. Raghavendra Rao

Second Party

Designation: President, A Shama Rao Foundation

State : Karnataka

Kiran Hebbar

First Party

Designated Partner,

Akar training & consultancy LLP,

Karnataka

Dated:

Witness

Name:

Second Party

Designation:

State

Date

Witness

Name:

First Party

Designation:

State

Date:

WIND TUNNEL MANUAL

SRINIVAS INSTITUTE OF TECHNOLOGY, MANGALORE

SUNRISE TECHNOLOGY
#9/2, opposite Akai public school,
Channamma Choultry Road.
R.M.V 2nd stage, Sanjay Nagar,
Bangalore-560094
TEL: 9482228729

INDEX

1.INTRODUCTION

Wind tunnel is a facility for creating a uniform wind of known value in a duct where fluid flow phenomena can be investigated. It is also very highly useful for training and teaching students in fluid mechanics/aerodynamics. The facility can also be used for testing aircraft models to obtain their performance characteristics and flow features around it. It is also highly useful in industrial aerodynamic testing and simulation studies related to many problems in fluid mechanics. The wind tunnel facility could be specific to the major application required. Actual aircraft model testing may require a high Renold's number facility. A smoke flow visual station tunnel could be a small tunnel.

2. THE FACILITY

The line sketch of facility is given in figure 1. The main parts of the tunnel are numbered and named below the figure. The nominal dimensions of the facility are marked on the figure. The specifications of the facility are also given below.

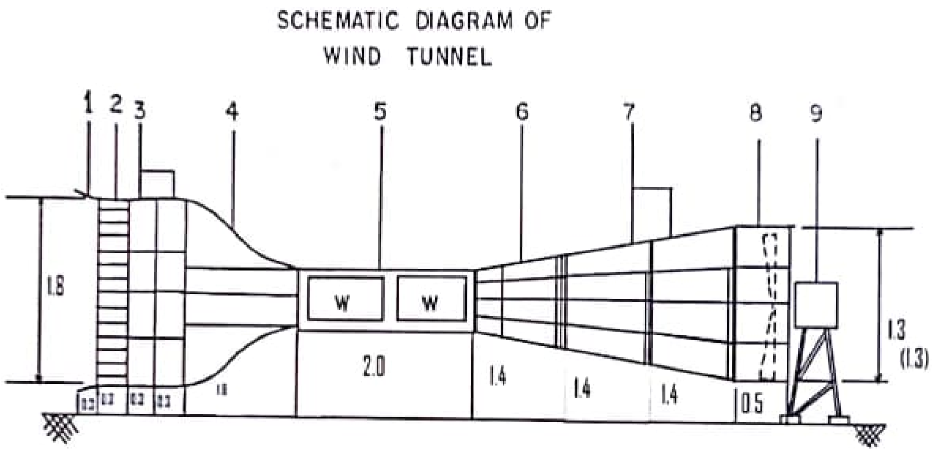


Figure1: Schematics of the wind tunnel.

PARTS.

1. Bell mouthed section.
2. Honey Comb.
3. Settling Chamber, and screen sections.
4. Contraction cone.
5. Test Section.
6. Transition (square to circular)
7. Diffuser.
8. Fan Duct.
9. Motor and Stand.

SPECIFICATIONS:

Test Section Size	:	Cross Section: 600mm×600mm. Length: 2000mm.
Maximum Speed	:	45m/sec.
Fan	:	Axial Flow fan of Diameter: 1.3 meter. Maximum rpm: 1450 Number of Blades: 12 Hub Diameter: 500mm. Spinner is provided.
Contraction Ratio	:	9: 1
Contraction length	:	1.8m
Settling chamber	:	1800mm×1800mm
Entry section	:	Bell mouthed entry.
Honey Comb Size	:	25mm×25mm×200mm.
Screens	:	Two screens 8mesh and16mesh stainless steel.

Provision to put smoke rake: provided in the contraction cone.

Power	:	22KW AC motor, with speed control drive.

Test section has four Perspex windows for viewing inside the test section. The top can be opened for easy access to the test section so that it becomes convenient to set up experiments.

The fabrication of the tunnel is made using teak wood and waterproof plywood. The diffuser has a transition piece with square inlet and circular outlet. The diffuser angle is less than 9°so that separation is avoided in the diffuser. The speed of the tunnel can be varied continuously from 3 to 40m/sec. However continuous running of the tunnel is possible from 3m/sec to 40 m/sec. Below 3 m/sec speed the tunnel should not be run continuously, but can be run for very short durations only (the motor will get heated up if run for long duration at low RPM). These short duration runs can be intermittent allowing enough time for motor to cool in between.

The tunnel is provided with supports that are anchored to the ground. The motor stand is anchored appropriately in to the concrete foundation. The test section is on rollers so that the test section can be rolled out and if need be another test section can be rolled in. This facilitates maximum usage of tunnel.

An inclined manometer is also fixed on the tunnel. The two limbs of the manometer are connected to the static pressure holes one in the settling chamber just before the contraction and the other to that at the start of the test section. The reading on the manometer is very nearly the dynamic head of the fluid in the test section and it serves as a reference for keeping the tunnel speed constant. The inclination of the manometer is kept at 30° to the horizontal. At 30° inclination to the horizontal the liquid column length change is twice the vertical head. The magnification of two gives a better accuracy than the reading using conventional manometer. The tunnel is also provided with a pitot-static tube, which can be traversed across the tunnel cross section.

The fan and the tunnel diffuser exit diameters are designed to give 40m/sec wind speed in the test section at about 1450 rpm. The variable speed in the tunnel is obtained by varying the RPM of the fan. The fan is directly coupled to an AC motor whose speed can be varied using an AC motor controller. The controller and the motor require a 3-phase power. The instruction to power on the motor and the connection from the controller to the motor all are given in the instruction manual of the controller. The instruction manual of the controller is separately enclosed.

Since it is an open circuit tunnel, at large speeds there will be a considerable noise from the fan. It is therefore advised to work with ear plugs if working continuously at large speeds.

PERFORMANCE OF THE FACILITY.

At the time of commissioning, the fan was run up to a maximum rpm of 1450 rpm. The rpm indicated on the controller will normally be more than the rpm of the motor because of the slip at higher power consumptions at higher velocity in the tunnel. The dynamic head was measured using the inclined manometer attached to the tunnel. The rpm was gradually increased from the 100 rpm to 1450 rpm.

The wind speed in the tunnel was calculated using Bernoulli's law given below.

$$P_0 - p = 1/2 \rho V^2 \quad \text{..1}$$

Here P_0-> Static pressure in the settling chamber.
p-> Static pressure in the test section.
ρ-> Density of air.
V-> Velocity of air.

(P_0-p) measured is given by $\rho_w g h$ where ρ_w is the density of the liquid used in the manometer (Methyl alcohol is used at present), 'g' is acceleration due to gravity and 'h' is the vertical length of the liquid column sustaining the pressure.

Density of air at Mangalore is taken as 1.2. The density of alcohol is 0.8. If 'h' is measured in mms of alcohol column, the velocity is given by the following relationship.

$$V\,(m/s) = 3.61 \sqrt{h(mm)} \quad \text{..2.}$$

If the measured liquid column length on the inclined manometer is h_m then $h = (h_m - h_m\,(\text{initial}))/2$ because the inclination is 30° to the horizontal.

The tunnel performance was measured by varying the rpm of the rotor using the controller and measuring tunnel wind speed using the inclined manometer.

The table below gives the measurements made. The table indicates measured performance of the tunnel.

h_i is initial reading

Rpm (controller)	**Inclined manometer Reading (mm)** h_m	$(h_m - h_i)/2$	**Velocity (m/s) In the test section**
0	h_i=11	0	0
100	12	0.5	2.55
200	18	3.5	6.75
300	29	9	10.83
400	45	17	14.88
500	65	27	18.75
600	91	40	22.83
700	120	54.5	26.65
800	150	69.5	30.45
900	190	89.5	34.15
1000	233	111	38.03
1100	281	135	41.94
1200	330	159.5	45.59
1300	370	179.5	48.36
1400	420	204.5	51.62

Table 1: The Tunnel performance readings.

The reading of the inclined manometer attached to the tunnel was used to obtain the velocity in the tunnel test section. The figure 2 shown below gives the graph of tunnel performance as measured.

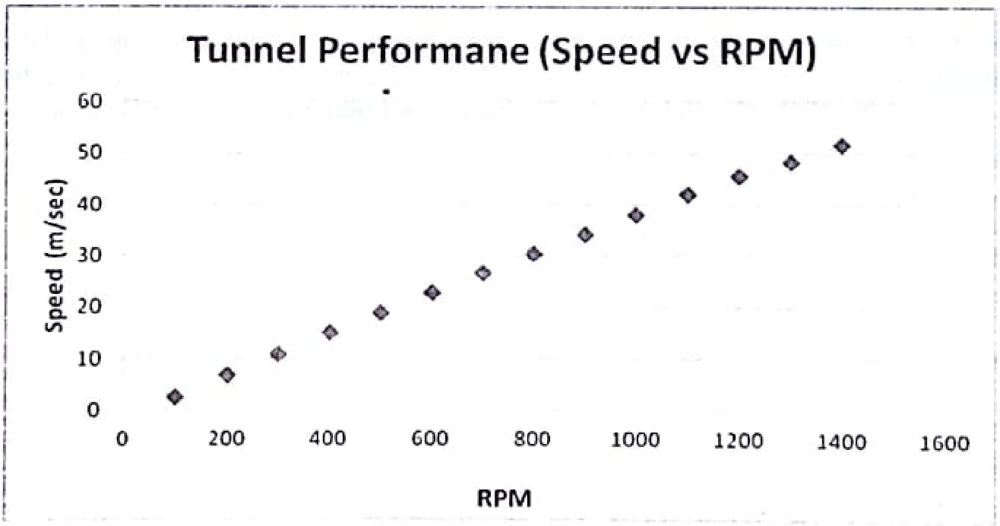


Figure 2

The performance obtained is satisfactory and as per the requirement and design.
The relationship between wind speed in the tunnel and rpm of the motor is very nearly linear as expected. At very low rpm it is very difficult to read accurately the manometer reading and hence there can be scatter in the reading. An accurate wind speed measurement will be required at less than 4m/sec wind speed for accurate calibration at low speeds. For this measurement one may use a vane anemometer wind speed which measures accurately up to as low as about 0.3m/sec wind speed.

The test section has been designed so that it is convenient for the user to set up experiments and also make flow visualization. The design also provides easy access to the experimental region. The test section is provided with top lid which can be removed in slots or full. The test section is also provided with 4 Perspex Windows two on each side. One wooden window is also provided for model mounting. A hole and a plug are provided on the wooden window. The models given by the sunrise can be mounted on this plug through a collar attached to this plug. A pointer attached to the model can be used for setting zero angles of the model as well as to indicate the orientation of the model with respect to the tunnel center line.

Note:

Sunrise also makes smoke generators for flow visualization. Smoke rake can be inserted in the contraction cone for visualizing flow pattern on the models. For flow visualization it is advised to make one of the side walls black such that the smoke can be seen well due to enhancement of the contrast against the black background. The user of the tunnel may keep a black paper or a black painted plywood wood sheet of appropriate size which fits exactly the side wall. The black color must be buff and must not be shining. This would enhance the clarity of the flow visualization which would enable to take good pictures. This facility will be provided on request at additional cost.

For student demonstration of flow past streamlined and bluff bodies and the pressure distribution on such body's **sunrise** makes flow visualization models which span the test section and also pressure distribution models. The models supplied along with the tunnel are the following.

- NACA 66_2-015. It is a 15% thick symmetric aerofoil. The model has a chord of 150mm and a span of 600mm.
  The model can be held on the wooden plug of the window and then rotated. Co-ordinate of this aerofoil is given in table 2a.

- Cambered aerofoil (having NACA 66_2-015 as the basic aerofoil), 15% thick with chord of 150mm and span of 600mm.
  The model can be held on the wooden plug of the window and then rotated. Co-ordinate of this aerofoil is also given in table 2b.

- Circular cylinder model which is 50mm in diameter and 600mm span. This can also be held on the wooden plug of the window.

- An aircraft model.

- A car model.

Both aircraft and car models are supported through struts going through the wooden plug and they can also rotated in pitch.

Table 2.

a) Symmetric Aero foil:

150 mm chord length 15% thick
Aero foil: NACA- 66_2-015.
Data from Abot and Van-Doenoff

X, mm	Y, mm
0	0
0.75	1.683
1.125	2.015
1.875	2.513
3.75	3.353
7.5	4.65
11.25	5.672
15.00	6.537
22.50	7.929
30.00	8.993
37.50	9.815
45.00	10.434
52.50	10.875
60.00	11.145
67.50	11.243
75.00	11.175
82.50	10.925
90.00	10.439
97.50	9.558
105.00	8.364
112.50	6.448
120.00	5.397
127.50	3.795
135.00	2.22
142.50	0.849
150.00	0

b) Cambered Aero foil:

150 mm chord length 15%
Basic Aero foil: NACA- 66_2-015.
Data from Abot and Van- Doenoff.
Cli=1.0 at 4.56° angle of attack
$Cm_{c/4}$ = 0.083.

Bottom Y, mm	X, mm	Upper Y, mm
-0.990	0	0.0
-0.993	0.75	2.373
-1.054	1.125	2.9771
-1.067	1.875	3.959
-0.892	3.75	5.815
-0.611	7.50	8.699
-0.412	11.25	10.933
-0.296	15.00	12.779
-0.243	22.50	15.615
-0.373	30.00	17.614
-0.644	37.50	18.986
-1.019	45.00	19.850
-1.466	52.50	20.285
-1.950	60.00	20.340
-2.437	67.50	20.050
-2.901	75.00	19.449
-3.304	82.50	18.547
-3.568	90.00	17.311
-3.51	97.50	15.606
-3.197	105.00	13.532
-2.694	112.50	11.202
-2.072	120.00	8.723
-1.389	127.50	6.201
-0.701	135.00	3.740
-0.149	142.50	1.550
0	150.00	0

Models with pressure ports for pressure distribution are also supplied as per request. The distribution of pressure ports along the card are given below. For the cylinder pressure are located at every 18 degrees on the circumference.

TABLE 3. Location of Pressure port holes along the card (Symmetric aerofoil)

Upper surface			Lower surface		
Hole No	Distance from leading edge X(mm)	X/C × 10	Hole No	Distance from leading edge X(mm)	X/C × 10
1	0	0	14	6.0	10
2	1.5	0.1	15	12.0	0.4
3	3.0	0.2	16	22.5	0.8
4	6.0	0.4	17	40.5	1.5
5	12.0	0.8	18	58.5	2.7
6	22.5	1.5	19	78.0	3.9
7	40.5	2.7	20	97.0	5.2
8	58.5	3.9	21	117.0	6.5
9	78.0	5.2	22	135.0	7.8
10	97.0	6.5			
11	117.0	7.8			
12	135.0	9			
13	150.0	10			

Table 4. Location of Pressure port holes along the card (Cambered aerofoil)

Upper surface			Lower surface		
Hole No	Distance from leading edge X(mm)	X/C × 10	Hole No	Distance from leading edge X(mm)	X/C × 10
1	0	0	14	6.0	10
2	1.5	0.1	15	12.0	0.4
3	3.0	0.2	16	22.5	0.8
4	6.0	0.4	17	40.5	1.5
5	12.0	0.8	18	58.5	2.7
6	22.5	1.5	19	78.0	3.9
7	40.5	2.7	20	97.0	5.2
8	58.5	3.9	21	117.0	6.5
9	78.0	5.2	22	135.0	7.8
10	97.0	6.5			
11	117.0	7.8			
12	135.0	9			
13	150.0	10			

Table 5: Location of Pressure port holes on the cylinder circumference.

	Units in degrees	
Hole No	Config (a)	Config (b)
1	-40	-30
2	-10	0
3	0	10
4	10	20
5	15	25
6	20	30
7	25	35
8	30	40
9	40	50
10	50	60
11	60	70
12	70	80
13	75	85
14	80	90
15	90	100
16	100	110
17	110	120
18	130	140
19	150	160
20	170	180

Note:

Config (a): When tube no.3 or hole no.3 is aligned opposite to flow direction pressures in hole no.1 and 9 will be same. They are at 40° on either side of 3.

Config (b): Hole no.2 also can be aligned in the direction opposite to flow. In this case pressure on hole no.1 and no.6 will have the same pressure. They are at 30° on either side of 2. In case of config (b) the pressure in hole 1 and 6 will also be equal to P_∞. Hence alignment in this way would be better. Pressure port at 180° will also be available in this config.

3. PRECAUTIONS TO BE TAKEN WHILE RUNNING THE TUNNEL.

1. Do not allow any one to stand behind the motor while the tunnel is being run. It is best to enclose the fan motor assembly by a strong wire/ mesh enclosure and allow only authorized personal to have access to the motor and fan area.

2. Before starting the tunnel check whether any loose parts are in the test section and remove them before start. Secure rigidly the models measuring probes, instruments etc, so that they don't fly off. Any loose parts when they fly off can damage the blades and can be dangerous to personal who could be behind the motor fan assembly.

3. Don't run the tunnel below 100 rpm continuously, this may heat up the motor and damage the windings of the motor. Intermittent running at lower speeds is allowed. But do not exceed more than a minute or two. Feel the temperature of the motor after running for short period at lower speeds. After some experience the user will get a feeling of how long the motor can be run at lower speeds.

4. At higher rpm the fan noise could be irritable. Hence personal should use ear plugs or ear mufflers while the tunnel is being run. Prolonged exposure to this noise may impair the hearing capability.

5. As far as possible do not run the tunnel for long time at higher speeds.

6. It is recommended that blade angle setting be checked regularly once in a few months. While checking the blade angle setting check also the gaps between the blades and the surface of the fan section of the diffuser. Check also whether any blades have become loose. Angle setting of the blade can be made with respect to circumferential line on the inside of the fan section. The circumferential line can be drawn with a pointer pen/ pencil attached to the trailing edge of blade so that the pen makes a mark on the surface and rotating the fan slowly by hand. Stick an angular pointer made on the inner surface such that it indicates the angle that has to be set for the blade tip. The angle that is set at present at the top is 10.5°. All the blades are set to this angle to the visual accuracy. Provision is made so that the blades can be removed and fitted with out moving the motor fan assembly. On the fan section of the diffuser there is a small window which can be opened. Once this is open any fan blade can be taken out through the wind tunnel diffuser after fan holding nuts are removed. Inserting the fan also will be done through the same window. After these checks are made for few months the user gets a feel and then he can decide about the periodicity of these checks.

7. The controller manual is separately given. Make sure that only competent people handle the controller. Mains power connection must be highly secured. Some times electricity board might change phases without

informing the customers. In that case the motor will rotate in opposite direction and then there will not be any flow through the tunnel. In that case the motor phases have to be changed appropriately for running properly. Make sure that the persons who operate the controller reads through the manual and understand the implementation.

8. There is a safety screen before the fan section. Make sure nothing is sticking to it and also make sure that it is not loose.

9. Close the top lid of the tunnel and the windows and secure it tight using C clamps before running the tunnel. If the tunnel is run with top lid and windows open loose object outside the tunnel can be sucked into the tunnel and cause damage to the tunnel.

10. Provide a cloth screen in front of the entry section of the tunnel and keep it closed whenever the tunnel is not in operation. When the tunnel is to be run the screen can be removed away from the air coming to the tunnel.

11. When the smoke visualization is not done it is advised to remove the smoke rake. After running smoke for some time it is better to blow fresh air through the smoke rake to clean the tubes.

NOTES ON AERODYNAMICS LABORATORY

Experiments with a typical Open circuit wind tunnel

1.INTRODUCTION

Understanding fluid flow phenomena is important in many branches of engineering like Aerospace, Mechanical, Civil and Chemical. Many applications in these engineering fields need the use of fluids and the flow of fluids. Aerospace engineering has the largest need of wind tunnels and hence a typical low speed wind tunnel becomes a necessity in any institution that teaches and trains students in aerodynamics and fluid mechanics. A typical low speed wind tunnel with a 600X900 mm cross section of the test section, achieving a maximum speed of 30-40 m/s wind will be highly suitable and desirable for aerodynamics laboratory in such institutions.

The following notes briefly list the typical fluid mechanics and aerodynamics experiments which may be used as a laboratory course in these subjects at the first degree level. The experiments are based on the simple aerodynamic models and instrumentation which from the accessories to any low speed wind tunnel. Each instructor can add additional innovative experiments to this note and widen the scope of the instruction set. Many other flow problems can be illustrated by construction of additional modules. A short list of such experiments is included at the end of this note. The instructor can develop a brief methodology for these experiments and make these notes rich.

2.EXPERIMENTS

The experiments broadly fall into two categories, viz:

(a) Flow pattern visualization, and

(b) Measurements.

The recommended tunnel speed for smoke visualization experiments is about 4m/sec with the smoke generator and the 16 tube or more smoke rate. For the experiments requiring measurement higher tunnel speeds up to the maximum should be used.

(d) Comparison of flow patterns observed with in viscid theory.

EXPERIMENT 6: Flow past an airfoil with control surface:

Notes:

(a) Observe affect of control surface deflection on the general flow pattern.

(b) Observe the details of flow near the control surface at various deflection angles – especially onset of separation and loss of effectiveness.

EXPERIMENT 7: Flow in A Convergent-Divergent Channel:

Notes:

(a) Observe the stream line spacing changes on both sides of the throat. Application of the continuity equation allows an approximate indication of the velocity field.

(b) Observe the flow unsteadiness in the divergent portion of the channel illustrative of the basic phenomenon of boundary layer separation from surfaces caused by adverse pressure gradients.

EXPERIMENT 8: Flow past a two-dimensional Intake:

Notes:

(a) For the zero incidence case observe the changes which occur in the approach streamlines ahead of the intake lips, with the intake passage closed by the valve and with the valve open. The flow through the intake increases.

(b) Observe the flow inside the intake for various positions of the valve with small inflow ratios there is separation at the lips.

(c) Observe the flow patterns with the intake at incidence.

EXPERIMENT 9: flow past a three- dimensional straight wing:

Notes:

(a) Observe the three- dimensional nature of the flow near the wing tips. With increasing incidence there is increasing tendency for the flow to be inward on the surface and outward on the lower surface and this causes the formation of the tip vortex. Higher the incidence (and hence C_L) stronger is the tip vortex.

(b) Observe the stall pattern-it is progressive from the root to the tip.

EXPERIMENT 10: flow past a three- dimensional 45° Swept wing:

Notes:

(a) Observe the general effect of sweep on the flow – a tendency of the flow to drift towards the tips. Relatively stronger tip effects.

(b) Observe the stall pattern. The tips have a tendency to stall earlier.

EXPERIMENT 11: Flow past an Ax symmetric streamlined body of Revolution:

Notes:

(a) Observe absence of separation even for the small incidences. ~ a small wake indicating relatively low drag.

(b) At sufficiently large incidences the flow lines curve characteristically across the axis of the body and vortex formation can be for large enough incidence there is flow break-away at the rear.

2(b)MEASUREMENTS:

EXPERIMENT 12:Calibration of Pitot-Tube for Incidence Errors:

Notes:

(a) Use the standard Pitot - static tube and obtain its readings against the Tunnel P_0 and p_{static}

(b) At the given speed setting of the Wind Tunnel measure the reading of the Pitot - static tube as a function of the incidence angle Θ Plot the pitot –static readings Vs Θ in the following form to obtain 3 curves:

(1) $Cp = (P_o\text{-pstatic}) /(\rho U^2)$ Vs Θ.

(2) $\Delta H/q=(P_o(\Theta) - P_o(\Theta=0)) / \rho U^2$ Vs Θ.

(3) $\Delta p/q = (p_{static}(\Theta) - p_{static}(\Theta=0)) / \frac{1}{2}\rho U^2$ Vs Θ.

(c) By taping up one set of static holes observe the difference in sensitivity of the static pressure to incidence (Less effect if top and bottom holes are taped up rather than the side ones).

EXPERIMENT 13:Measurement of the Pressure-Distribution and Losses in the contraction, Test Section and Differ of the Wind Tunnel:

Notes:

(a) Measure the axial static pressure distribution along the entire length of the wind Tunnel. Plot the results in non-dimensional form as a curve of Cp Vs X/L (where L is some standard length such as Test Section height.)

(b) Measure the total head against atmospheric pressure at the following stations:

(1) After the screens, at the start of diffuser, and just before the fan.

(2) In the Test Section

(3) At the end of the diffuser just before the fan.

Calculate the individual and the combined loss.

EXPERIMENT 14:Mesurement of Pressure distribution on a Circular Cylinder:

Notes:

(a) Obtain the Cp= p (cylinder)-p (tunnel static)/ $_{\rho}$ u^2 Vs Θ readings using 5degree intervals for 0 to 180 degrees (the other half is symmetrical). Repeat for four different speeds (Reynolds Nos). 5 degree interval can be obtained by rotating the cylinder by 5 degrees each time.

(b) Plot Cp Vs Θ curves on polar coordinate paper as well the usual Cartesian plot. On the polar coordinate plot the normal static pressure distribution at various points of the cylinder is clearly seen by indicating arrows point away from the cylinder surface in regions where the pressure is lower than free stream (suction) and they point toward the cylinder where it is higher.

(c) Note and mark the following points:

(1) The points of minimum and maximum pressure on the cylinder. Calculate the velocity at these points.

(2) The point where pressure on the cylinder is equal to the free stream value.

(d) By graphical integration of the pressure distribution obtain the drag coefficient for each Reynolds Nos. and plot a Cd Vs R.No.curve.

(e) Compare the results of (b), (c) and (d) with theoretical results.

EXPERIMENT 15: Determination of the aerodynamic characteristics for the N.A.C.A 23015 Aerofoil:

Notes:(Manufacturer will supply this Aerofoil on request)

(a) Connect the pressure distribution model to the multi-channel manometer and set it at zero geometric incidences.

(b) Select a tunnel speed and measure the pressure distributions on the upper and lower surfaces from -10 ° to + 20° angles of attack at intervals of 2°.

(c) During the measurements note how the pressure distribution changes as the incidence is increased – in particular how near the stall the upper surface suction gets destroyed with in a couple of degrees incidence change. Here recall the flow pattern changes noted during experiment 5.

(d) Plot all the measured pressure distributions as Cp Vs x/c and Cp Vs y/c plots. Find the normal force coefficient Cn == ∫cp.d(x/c) on both upper and lower surfaces and obtaining the difference and chord wise coefficient-by the graphical integrations. The lift coefficient is given by

$$C_L = C_N \cos \partial - C_C \sin \partial$$

Where ∂ is the angle of incidence. Also the form drag (or the pressure drag) coefficient is given by $C_D = C_N \sin \partial + C_C \cos \partial$

(Note that C_D is not the total drag coefficient of the profile.

$C_{DTOTAL} = C_D + C_{Dskin}$ friction. In the above experiment only the pressure drag can be determined. See experiment 18 for C_{Dtotal} determination).

The pitching moment coefficient about the leading edge can also be determined by the expression

$C_{N\,L.E.} = \int C_P\,(x/c).d(x/c) + \int C_P.\,(y/c).d(y/c)$

The integrations must be done graphically using the C_P Vs x/c and C_P Vs y/c plots.

The moment about any other point say x/c = A is given by

$C_M = C_{N\,L.E} + A\,C_N$

In particular calculate and plot the quarter chord moment Vs ∂ from the equation

$C_{Mchrd} = C_{N\,L.E} + \frac{1}{4}\,C_N$

(e) Plot the C_L, C_D, C_N Vs curves for various R.nos. Note the effect of R.NO. on C_{Lmax}, α stall, ∂CL/ ∂α etc.

EXPERIMENT 16: Determination of the Aerodynamic Characteristics of an N.A.C.A 65_2-015 Low Drag wing Section:

Notes:

(a) The NACA 65_2-015 is a low drag wing section specially designed to produce extensive regions of Laminar flow. It has very low drag at low incidences.

(b))
(c)) Repeat the procedure of Experiment 15.
(d))
(e))

(f) Compare the aerodynamic characteristics of the NACA 65_2-015 with the NACA 23015 Airfoil.

EXPERIMENT 17: Effect of control surface deflection on the Aerodynamic Characteristics of an Airfoil:

Notes:

(a) Install the flap attachment to the pressure distribution model.

(b) Repeat the procedure of the Experiment 15 with flap in position.

(c) Compare the aerodynamic characteristics with and without flap.

(d) Recall the flow patterns of Experiment 6 for correlation with the measurements.

EXPERIMENT 18: Measurement of Profile drag by wake survey Method :

Notes:

(a) Install the airfoil in the front window and the total head tube at the rear.

(b) For a fixed incidence of the airfoil and Tunnel speed, traverse the total head probe in the range such that total pressure becomes constant at either ends.

Use the method described in the typical experiment to determine the drag of a body described later.

(c) Determine C_D for various angles of wing and plot a C_D V_s α curve.

(d) Determine C_D for various Reynolds Nos. (By changing tunnel speed) and plot a C_D vs R. No. curve.

(e) Note that for a given tunnel speed and incidence measurements of the total head in the wake at varying distances from the airfoil should all give the same C_D.

(f) For wide wakes the rotating total head tube should be replaced by a rate as incidence errors will become large.

(g) By combining the results of this experiment with this of Experiments 15 and 16 it is possible to find the skin friction drag of an Airfoil.

Since $C_{D\text{skin friction}} = C_{D\text{profile}}$ (Expt.18)-$C_{D\text{pressure.}}$ (Expt.15)

Typical experiments to determine lift on an Aerofoil

Procedure:

1) Set the Aerofoil at a specified angle of attack **Θ**.
2) Set up a Pitot static tube at the corner in the beginning of the test section and connect the leads to the Projection Manometer. The Pitot static tube must be outside the boundary layers on the surface.
3) Set the rpm of the fan at the speed the lift is being measured.
4) Connect the leads of the pressure ports to the Multi-tube Manometer and set the angle at a convenient at an angle **Φ**.
5) Use the T connection to the Static leads of the Pitot static tube and connect one of the T leads to one of the tubes of the Multi-tube manometer say N in tube.
6) Start the tunnel. When the speed has become steady measure the dynamic head from the Projection Manometer and records the measurements of all the pressure ports including the N_{th} tube.
7) Calculate the speed of the tunnel using the formula

$$V\ (m/s) = (3.62\ \sqrt{(h_d - h_{din})}) \ldots\ldots\ldots\ldots 1$$

The coefficient of pressure defined at any port i is

$$C_{pi} = \frac{(p_i - p_N)_{(in\ mm)} \cdot \sin\Phi}{(h_d - h_{din})_{(in\ mm)}} \ldots\ldots\ldots\ldots 2$$

Plot this value of C_{pi} versus X/C in a graph sheet. X\c Vs the pressure port number are given in table 3 and 4. Use the appropriate table for the Aerofoil used.

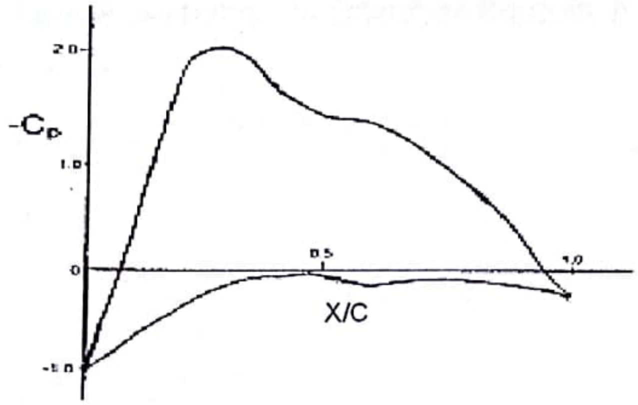


Figure 4. Typical pressure distribution at an angle of attack

Area under this curve gives the integral

$$C_N = \int C_{pl}\ d(X/C) - \int C_{pu}\ d(X/C) \quad \text{..........3}$$

This is the normal force coefficient (force normal to the chord)
Where C_{pl} and C_{pu} are the pressure coefficients on the lower and upper surface of the Aerofoil. Similarly obtain the chord wise force coefficient C_c by integrating C_{pl} and C_{pu} Vs **Y/C.**
Lift coefficient can be calculated using the formula below.

$$C_L = C_N \cos \Theta - C_C \sin \Theta \text{.....................4}$$

From C_L lift can be calculated using the formula

$$C_L = \left[\frac{\text{lift/unit span}}{1/2 \rho V^2} \right] \text{...................5}$$

Note: while the experiment is conducted the reference Manometer head must be maintained constant so that the speed in the tunnel is kept constant.

Typical experiment to determine the drag of a body

Procedure:

1) Mount the body whose drag has to be measured.
2) Use a Pitot tube to traverse the total head distribution beyond the body.
3) If the body is a bluff body like a cylinder mount a pitot tube to be traverse at around 10 diameter down stream of the cylinder.
4) If the body is Aerofoil mount the Pitot tube about 2 chord lengths beyond the Aerofoil.
5) Set up a Pitot static tube at a corner at the beginning of the test section and connect the leads to the Projection Manometer.
6) Make a scale and mark on the Pitot tube or connect it to a vertical traverse.
7) Start the tunnel at the required rpm corresponding to a specified speed.
8) Measure the dynamic head using the Projection Manometer.
9) Traverse the Pitot tube on the wake from one end to the other so that at either ends the readings have attained constant values.

Connect the static pressure of the Pitot static tube at the beginning of the test section to static pressure lead in the Projection Manometer and connect the Pitot tube being traversed to the total pressure lead of the projection Manometer and take the traverse readings.

Then calculate **($P_o - P_i$)** at various points in the wake.

Let **u_i be** the velocity at each point of the traverse. At the end points velocity will be free stream velocity **U.**

The Drag of body is given by the relation

Drag / unit length = $\rho \int u_i(U-u_i)dy$ **1**

$$C_d = \frac{\text{drag}}{1/2\rho V^2} = 2\int_{-\infty}^{\infty} \frac{u_i}{U}\left(1 - \frac{u_i}{U}\right) d(y/d) \quad \text{..................... 2}$$

But $\frac{u_i^2}{U^2} = \frac{\Delta P_i}{\Delta P_\infty}$ where ΔP is the head measured by the projection monometer.

Therefore

$$C_d = \int_{-\infty}^{\infty} \left(\sqrt{\frac{\Delta P_i}{\Delta P_\infty}} - \left(\frac{\Delta P_i}{\Delta P_\infty}\right)\right)\frac{dy}{d} \quad \text{..................... 3}$$

Where **d** is the length scale of the object.

LIST OF ADDITIONAL EXPERIMENTS

1. Flow past a delta wing.
2. Flow past an artificial with a leading edge slot
3. Flow past a rotating propeller
4. Flow patterns around a wing profile with a jet flap
5. Flow patterns around a ground effect machine
6. Turbulence level measurements by means of base pressure measurement on a sphere.
7. Span-wise lift distribution on a finite wing.
8. Measurement of laminar and turbulent boundary layer profiles on a flat.
9. An oscillating airfoil and the phenomenon of flutter.
10. Measurement of downwash behind a finite wing.

FURTHER LIST OF EXPERIMENTS:

- **Performance of the tunnel**
  - Rpm Vs velocity in the tunnel.
  - Velocity distribution in the tunnel.
  - Calibration of △P across test section and setting chamber Vs the plot state reading.
  - Turbulence level in the tunnel.
- **Losses in the tunnel measurements.**
- **Pressure rise across the fan estimation of Energy ratio.**
- **Pressure distribution on aero foils:**
  - Symmetric.
  - Chambered
    - Calculation of CL and CP.
    - CL Vs alpha
      CM Vs alpha
    - Measurement of drag hysteresis.
    - Drag polar
- **Pressure distribution on cylinder.**
- **Drag calculation on cylinder.**
- **Drag measurement by wake survey.**
- **Wake measurement very near the cylinder and far away from the cylinder**
- **Smoke flow visualizations on slender and bluff bodies (2D as well as 3D).**
- **Explanation of drag variation with respect to flow visualization.**
- **Flow visualization using tuft, oil droplets and surface coatings.**
- **Experiments on boundary layer.**
- **Location of separate point and contours of separation on 3D bodies.**
- **Laminar boundary Layer skin friction calculation.**
- **Turbulent** boundary **Layer skin friction calculation.**
- **Transition boundary Layer skin friction calculation.**
- **Skin friction measurements using hot film gauges.**
- **Development of wakes jets and shear layers.**
- **Vertex dominated flows: Wing tips, Delta wings.**

STEPS TO STE 30 RPM IN AC DRIVE

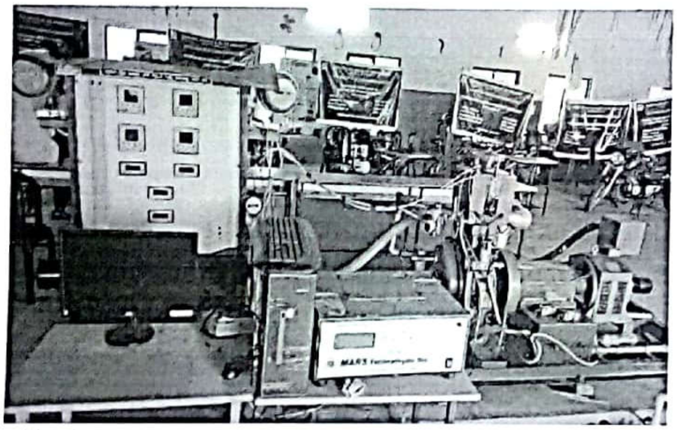
1. By pressing △ ▽ key you can go to all the parameters in Drive.
2. Go to **SPEED CONTROL** press enter go to **SPEED LIMIT** enter go to **MIN + FREQ** change the frequency by pressing △ ▽ key and set to **1Hz** and press **ESC** key MAIN PAGE will display.
3. Go to **SPEED CONTROL** press enter go to **START FREQUENCY** press enter change the frequency to **0.50Hz** by pressing △ ▽ and press **ESC** key MAIN PAGE will display.
4. Press the **SAVE** key 2 times the changed settings will be saved.
5. Press △ key go to **FREQUENT MODE** press enter **NORMAL SPEED** again press enter _ cursor will be blinking change the speed to **30 RPM** by Pressing down key and press ESC.
6. Press **SAVE** key changes will be saved.

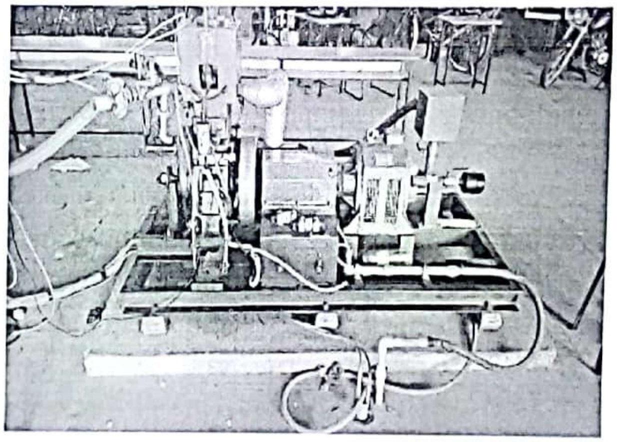
SAME STEPS TO 10RPM ALSO

NOTE: In speed limit 1 Hz should be changed into 0.5 Hz

Multi Fuel Engine Test Rig

Description: The setup consists of single cylinder, four stroke, VCR (Variable Compression Ratio) Research engine connected to eddy current dynamometer. It is provided with necessary instruments for combustion pressure, crank-angle, airflow, fuel flow, temperatures and load measurements. These signals are interfaced to computer through high speed data acquisition device. The set up has standalone panel box consisting of air box, twin fuel tank, manometer, fuel measuring unit, transmitters for air and fuel flow measurements, process indicator and piezo powering unit. Rotameters are provided for cooling water and calorimeter water flow measurement. In petrol mode engine works with programmable Open ECU, Throttle position sensor (TPS), fuel pump, ignition coil, fuel spray nozzle, trigger sensor etc. The setup enables study of VCR engine performance for both Diesel and Petrol mode and study of ECU programming. Engine performance study includes brake power, indicated power, frictional power, BMEP, IMEP, brake thermal efficiency, indicated thermal efficiency, Mechanical efficiency, volumetric efficiency, specific fuel consumption, Air fuel ratio, heat balance and combustion analysis.





Features

- Changing CR without stopping the engine
- Study of Open ECU
- Performance optimization with ECU programming
- Diesel and Petrol operation
- Diesel injection point advancement
- Electric starting arrangement
- PΘ-PV plots, IP, IMEP, FP indication
- Combustion analysis

Open ECU

- Fuel Control with fuel table
- Barometric Pressure, Acceleration, Deceleration, Battery, Air Temp, Coolant Temp and Starting compensations.
- Adjustable injection timing control
- Adjustable ignition control
- Built in igniters
- Advanced diagnostic features
- Advanced tuning software

- Ethernet connection

Software

Engine Soft is Labview based software package developed by Apex Innovations Pvt. Ltd. for engine performance monitoring system. Engine Soft can serve most of the engine testing application needs including monitoring, reporting, data entry, data logging. The software evaluates power, efficiencies, fuel consumption and heat release. Various graphs are obtained at different operating condition. While on line testing of the engine in RUN mode necessary signals are scanned, stored and presented in graph. Stored data file is accessed to view the data graphical and tabular formats. The data in excel format can be used for further analysis.

Specifications

Engine: 4 stroke 1 cylinder water cooled multi fuel engine
Basic engine: Kirloskar
Rated power: up to 5 HP (DIESEL)
Rated power: Up to 3 HP (PETROL)
Bore dia.: 80mm
Stroke length: 110mm
Connecting rod length: 234mm
Swept volume: 552cc
Compression ratio: 6:1 to 10:1 for petrol and 12:1 to 20:1
Rated Speed: 1500 rpm

Dynamometer: Eddy current dynamometer
Rated torque: 24. N-m
Rated Power : 5 HP
Speed:1500 rpm

Computer: Pentium IV, 2.66GHz
HDD: 80 GB
RAM: 1 GB
ROM: RW cd drive (Combo drive)
Monitor: 17" color monitor
Mouse: Optical mouse
Keyboard: Multimedia key board with 108 keys
Printer: HP Desk jet color printer (A4)

Recommended fuels
Diesel
Petrol
Bio diesel
Various oils blended with diesel

Test rig Constants

Orifice dia.: 20 mm
Density of air: 1.193 kg/m^3
Density of water: 1000 kg/m^3
Density of petrol: 0.73 gram/cc
Density of diesel: 0.82 gram/cc
CV of petrol: 44500 kJ/kg
CV of diesell: 42000 kJ/kg
Value of cd: 0.62
Value of "Cp" for water: 4.18 kJ/kg °K

R and D Activities

For students, it's necessary as a result of they get exposure to R&D activities and future placement in varied disciplines. On the opposite hand, with the appearance of globalisation and gap of the Indian economy to outside world, competition among the R&D has become stiff. Therefore R&D conjointly want smart students who are well aware of R&D standards and capable of achieving so. Therefore, there's an urgent need for interaction of R&D centers and teachers wherever academic institutes will prepare students for jobs in R&D based multinational companies and industry also will be benefited by the possibility of receiving well-trained workforce.

Objectives:

- ✓ To cultivate the strong links with R&D centers.
- ✓ To promote various research activities by the faculty members and students.
- ✓ To catalyze the further growth and development of interaction between the Institute and various R&D centers.
- ✓ To have a closer linkage and promote research suited to research needs, and consultancy which creates a sense of owning among faculty members.
- ✓ To provide continuing education to people working in industries so that they can upgrade their technical knowledge, and/or obtain higher degrees; this orients the faculty members towards the research from the portals of College i.e. Academics.
- ✓ To enable academics to take a sabbatical in industries; provide internships for students in R&D centers, which will prepare the students better for entering the R&D sector;
- ✓ To bring about MOU'S and Agreements with various research organizations in different fields and sectors to promote various forms of interactions.

Activities carried out under R&D centre:

During 2015-2016:

- ➢ Functional MoU with research organization/ institution has been done with department of microbiology, university college;
    1. To assist and guide the students for projects and their research work.
    2. To conduct seminar, symposium, workshops conference etc. with mutual collaborations.
    3. To organize other activities of mutual academic interest for the students.

During 2016-2017:

- ➢ During the academic year 2016-2017 the students of our department has actively involved themselves in research activities and got good results which brings confidence in them to publish the research work in international journals.
- ➢ Meanwhile we also focused on helping the students for synthesizing & characterization facility for their research work by giving accessibility to use the muffle furnace for synthesizing nanoparticles by solution combustion method, and characterization instrument like UV-Vis spectrophotometer instrument for studying absorbance phenomena of a sample.

Center for Research in CNC Machining
Co-ordinator : Prof. Vasudev Bhat