**List of Tables**

3.1 Advantages and Disadvantages of various Gasifiers

3.2 Composition of Producer Gas from various fuels

**List of Figures**

3.1 Use of Biomass for energy

3.2 Products of Gasifier

3.3 Various types of gasifiers

3.4 Various zones in downdraft gasifier

3.5 Various zones of cross draft gasifier

3.6 Single and double throat gasifiers

3.7 Dust content as a function of gas production

4.1 Pictorial View of the Experimental Set-up

4.2 Photograph of the Experimental Set up

4.3 Photograph of the Air flow meter

4.4 Preparation of feed stock for the gasifier

4.5 Gasifier feed stock containing moisture

4.6 Gasifier feed stock after air drying

4.7 Photograph of the Exhaust Gas Analyzer

4.6 Photograph of the Smoke meter
5.1 Effect of injection pressure on Brake Thermal Efficiency in dual fuel mode with different combinations of producer gas at 25% engine load

5.2 Effect of injection pressure on Exhaust Gas Temperature in dual fuel mode with different combinations of producer gas at 25 % load

5.3 Effect of Injection Pressure on CO emission in dual fuel mode with Diesel and various Producer Gas combinations at 25 % Load

5.4 Effect of Injection Pressure on HC emission in dual fuel mode with Diesel and various Producer Gas combinations at 25 % Load

5.5 Effect of Injection Pressure on NOx emission in dual fuel mode with Diesel and various Producer Gas combinations at 25 % Load

5.6 Effect of Injection Pressure on SD emission in dual fuel mode with Diesel and various Producer Gas combinations at 25 % Load

5.7 Effect of injection pressure on Brake Thermal Efficiency in dual fuel mode with different combinations of producer gas at 50% engine load

5.8 Effect of injection pressure on Exhaust Gas Temperature in dual fuel mode with different combinations of producer gas at 50 % load
5.9 Effect of Injection Pressure on CO emission in dual fuel mode with Diesel and various Producer Gas combinations at 50 % Load

5.10 Effect of Injection Pressure on HC emission in dual fuel mode with Diesel and various Producer Gas combinations at 50 % Load

5.11 Effect of Injection Pressure on NOx emission in dual fuel mode with Diesel and various Producer Gas combinations at 50 % Load

5.12 Effect of Injection Pressure on SD emission in dual fuel mode with Diesel and various Producer Gas combinations at 50 % Load

5.13 Effect of injection pressure on Brake Thermal Efficiency in dual fuel mode with different combinations of producer gas at 75% engine load

5.14 Effect of injection pressure on Exhaust Gas Temperature in dual fuel mode with different combinations of producer gas at 75 % load

5.15 Effect of Injection Pressure on CO emission in dual fuel mode with Diesel and various Producer Gas combinations at 75 % Load

5.16 Effect of Injection Pressure on HC emission in dual fuel mode with Diesel and various Producer Gas combinations at 75 % Load
5.17 Effect of Injection Pressure on NOx emission in dual fuel mode with Diesel and various Producer Gas combinations at 75 % Load

5.18 Effect of Injection Pressure on SD emission in dual fuel mode with Diesel and various Producer Gas combinations at 75 % Load

5.19 Effect of injection pressure on Exhaust Gas Temperature in dual fuel mode with different combinations of producer gas at no load

5.20 Effect of Injection Pressure on CO emission in dual fuel mode with Diesel and various Producer Gas combinations at No Load

5.21 Effect of Injection Pressure on HC emission in dual fuel mode with Diesel and various Producer Gas combinations at No Load

5.22 Effect of Injection Pressure on NOx emission in dual fuel mode with Diesel and various Producer Gas combinations at No Load

5.23 Effect of Injection Pressure on SD emission in dual fuel mode with Diesel and various Producer Gas combinations at No Load

5.24 Effect of injection pressure on Brake Thermal Efficiency in dual fuel mode with different combinations of producer gas at full engine load

5.25 Effect of injection pressure on Exhaust Gas Temperature in dual fuel mode with different combinations of producer gas at full load

5.26 Effect of Injection Pressure on CO emission in dual fuel mode with Diesel and various Producer Gas combinations at full Load
5.27 Effect of Injection Pressure on HC emission in dual fuel mode with Diesel and various Producer Gas combinations at full Load

5.28 Effect of Injection Pressure on NOx emission in dual fuel mode with Diesel and various Producer Gas combinations at full Load

5.29 Effect of Injection Pressure on SD emission in dual fuel mode with Diesel and various Producer Gas combinations at Full Load

5.30 Brake Thermal Efficiency Vs Engine Load in Diesel Mode at different fuel injection pressures.

5.31 Brake Thermal Efficiency Vs Engine Load in Dual fuel Mode - Diesel and Producer Gas (babul wood) at different fuel injection pressures.

5.32 Brake Thermal Efficiency Vs Engine Load in Dual fuel Mode - Diesel and Producer Gas (mango wood) at different fuel injection pressures.

5.33 Brake Thermal Efficiency Vs Engine Load in Dual fuel Mode - Diesel and Producer Gas (casuarina wood) at different fuel injection pressures.

5.34 Exhaust Gas Temperature Vs Engine Load in diesel mode at different fuel injection pressures.

5.35 Exhaust Gas Temperature Vs Engine Load in Dual fuel mode - Diesel and Producer gas (Babul wood) at different fuel injection pressures.

5.36 Exhaust Gas Temperature Vs Engine Load in Dual fuel mode - Diesel and Producer gas (Mango wood) at different fuel injection pressures.
5.37 Exhaust Gas Temperature Vs Engine Load in Dual fuel mode - Diesel and Producer gas (Casuarina wood) at different fuel injection pressures.

5.38 CO emissions Vs Engine Load in Fossil Diesel mode at different fuel injection pressures.

5.39 HC emissions Vs Engine Load in Fossil Diesel mode at different fuel injection pressures.

5.40 NOx Emissions Vs Engine Load in Fossil Diesel mode at different fuel injection pressures.

5.41 Smoke Density Vs Engine Load in Fossil Diesel mode at different fuel injection pressures.

5.42 CO emissions Vs Engine Load in Dual Fuel (FD+PG babul) mode at different fuel injection pressures.

5.43 CO emissions Vs Engine Load in Dual Fuel (FD+PG mango) mode at different fuel injection pressures.

5.44 CO emissions Vs Engine Load in Dual Fuel (FD+PG casuarina) mode at different fuel injection pressures.

5.45 HC emissions Vs Engine Load in Dual Fuel (FD+PG babul) mode at different fuel injection pressures.

5.46 HC emissions Vs Engine Load in Dual Fuel (FD+PG mango) mode at different fuel injection pressures.

5.47 HC emissions Vs Engine Load in Dual Fuel (FD+PG casuarina) mode at different fuel injection pressures.

5.48 NOx emissions Vs Engine Load in Dual Fuel (FD+PG babul) mode at different fuel injection pressures.
5.49 NOx emissions Vs Engine Load in Dual Fuel (FD+PG mango) mode at different fuel injection pressures.

5.50 NOx emissions Vs Engine Load in Dual Fuel (FD+PG casuarina) mode at different fuel injection pressures.

5.51 Smoke Density Vs Engine Load in Dual Fuel (FD+PG babul) mode at different fuel injection pressures.

5.52 Smoke Density Vs Engine Load in Dual Fuel (FD+PG mango) mode at different fuel injection pressures.

5.53 Smoke Density Vs Engine Load in Dual Fuel (FD+PG casuarina) mode at different fuel injection pressures.

5.54 Effect of various modes of operations on Brake Thermal Efficiency at 180 bar injection pressure

5.55 Effect of various modes of operations on Brake Thermal Efficiency at 210 bar injection pressure

5.56 Effect of various modes of operations on Brake Thermal Efficiency at 240 bar injection pressure

5.57 Effect of various modes of operation on Exhaust Gas Temperature at 180 bar injection pressure

5.58 Effect of various modes of operations on Exhaust Gas Temperature at 210 bar injection pressure

5.59 Effect of various modes of operations on Exhaust Gas Temperature at 240 bar injection pressure

5.60 Effect of various modes of operations on CO emissions at 180 bar injection pressure
5.61 Effect of various modes of operations on CO emissions at 210 bar injection pressure

5.62 Effect of various modes of operations on CO emissions at 240 bar injection pressure

5.63 Effect of various modes of operations on HC emissions at 180 bar injection pressure

5.64 Effect of various modes of operations on HC emissions at 210 bar injection pressure

5.65 Effect of various modes of operations on CO emissions at 240 bar injection pressure

5.66 Effect of various modes of operations on NOx emissions at 180 bar injection pressure

5.67 Effect of various modes of operations on CO emissions at 210 bar injection pressure

5.68 Effect of various modes of operations on CO emissions at 240 bar injection pressure

5.69 Effect of various modes of operations on Smoke Density at 180 bar injection pressure

5.70 Effect of various modes of operations on CO emissions at 210 bar injection pressure

5.71 Effect of various modes of operations on CO emissions at 240 bar injection pressure
List of Appendices

I  Specification of the Engine Test Rig
II  Specification of the Gasifier
III  Specification of the Gas - Cleanup unit
IV  Specifications of the Exhaust Gas Analyzer
V  Properties of Diesel and Producer Gas
VI  Comparison of Fuel Properties
VII  Thermo Chemical Properties of selected Woods