Read this first

Sample for study reference, not for submission. This file shows how an MMTP 001 project proposal for the M.Sc. (Mathematics with Applications in Computer Science), MSCMACS, can be laid out. It is not your proposal and must not be submitted to IGNOU, in whole or in part, under your name.

What it follows. The MMTP-001 Project Guidelines (School of Sciences, IGNOU, June 2010 imprint) ask for a proposal of about 1,500 words with five parts: the title; the introduction and objectives; the methodology and tools; the utility or scope of the work; and future directions for investigation. The sample below uses exactly those five parts, in that order. The same guidelines suggest "emission levels at selected points in a city" as a project problem, and this sample takes that problem.

What you must change. Everything in [square brackets] is yours to fill: the city, the stations, the years, the dates, your supervisor and your own reading. Choose your own problem with your supervisor: a proposal copied from a circulated sample risks being identical to someone else's, and the guidelines reject completely identical proposals or reports.

What goes with your real proposal. Form-A, the proforma for approval printed in your MMTP-001 Project Guide, filled in fully and signed and dated by you and your supervisor. In the 2010 guidelines the proposal and Form-A go to the Programme Facilitator of your Programme Study Centre, and you keep a photocopy of both. Confirm the current route with your centre.

How this file was made. Prepared by the ignouproject.com editorial desk with AI assistance in November 2026, checked against the MMTP-001 Project Guidelines, the MSCMACS Programme Guide (March 2025), the IGNOU Common Prospectus (July 2026) and the sources listed at the end, and published under BK Sahni's editorial responsibility. No data in this file is real station data; the study has not been carried out.

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Project Proposal

MMTP 001: Project

M.Sc. (Mathematics with Applications in Computer Science) (MSCMACS), School of Sciences, IGNOU

Item	Entry
Title of the project	Daily PM2.5 at Continuous Monitoring Stations in [City]: A Principal Component Analysis and ARIMA Forecasting Study Using CPCB Data, [Year] to [Year]
Name of the student	[Your name]
Enrolment No.	[Enrolment number as printed on your IGNOU identity card]
Programme Study Centre	[Name and code]
Regional Centre	[Name]
Project supervisor	[Name, designation, office address, telephone]
Subject area(s)	Statistics; time series; multivariate analysis; environmental data
Mathematical tools / software	Principal component analysis; ARIMA models; Python 3 (pandas, NumPy, statsmodels, matplotlib) [or R]
Place of doing the project	[Home / institution / organisation where the work will be done]
Date	[DD Month YYYY]

The last five rows repeat items that Form-A asks for. Keep the entries on this sheet and on Form-A identical.

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1. Title of the project

Daily PM2.5 at Continuous Monitoring Stations in [City]: A Principal Component Analysis and ARIMA Forecasting Study Using CPCB Data, [Year] to [Year]

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2. Introduction and objectives of the project

2.1 Background

Fine particulate matter of size less than 2.5 microns, written PM2.5, is one of the pollutants for which India sets a legal limit. The National Ambient Air Quality Standards notified by the Central Pollution Control Board on 18 November 2009 fix the PM2.5 limit at 60 µg/m^3 as a 24-hour average and 40 µg/m^3 as an annual average. The Board runs Continuous Ambient Air Quality Monitoring Stations (CAAQMS) whose readings are published on its Central Control Room for Air Quality Management portal, from which station data can be downloaded by city, station and period.

[City] has [number] continuous stations on the portal: [station names]. Each station reports several pollutants at once, so a single day at a single station is already a vector of readings, and the stations together form a multivariate time series. This makes the data a natural object for the methods of the MSCMACS programme: descriptive and inferential statistics from MMT-008 Probability and Statistics, model building from MMT-009 Mathematical Modelling, dimension reduction of the kind met in MMTE-003 Pattern Recognition and Image Processing, and programming from MMT-001 Programming and Data Structures.

The choice of [City] rests on reasons the learner states in his or her own words: [for example, you live or work there, the stations have long records, or the city is covered by a local clean-air plan]. A topic placed in the learner's own city also lets the data be read against what the learner can observe, such as the location of each station near roads, industry or residential areas, which is recorded in the report but not used as a variable.

2.2 Work already done

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Sharma and Mauzerall (2022) compiled and analysed CPCB continuous monitoring data for India for 2015 to 2019 and described the cleaning such data needs before analysis. [Add two or three studies on PM2.5 in your own city or region that you have read in full, with what each found and what it left open.] The present study narrows the question to the stations of one city and asks what structure the pollutants share and how well a univariate time series model forecasts daily PM2.5.

2.3 Objectives

The objectives are stated neutrally and do not assume any result:

1. To describe daily PM2.5 at each selected station in [City] for [Year] to [Year] and to count the days on which the 24-hour average exceeded 60 µg/m^3.

2. To examine, by principal component analysis, how PM2.5, PM10, NO_2, SO_2, CO and O_3 vary together at the selected stations, and how much of the total variance the leading components explain.

3. To identify, fit and compare ARIMA models for daily PM2.5 at [Station] and to measure their forecast error on a held-out period.

4. To study the month-by-month pattern of PM2.5 across the study period at the selected stations.

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3. Methodology and tools to be used

3.1 Data

Secondary data: 24-hour average concentrations downloaded from the CPCB Central Control Room portal for [number] stations in [City], [DD Month YYYY] to [DD Month YYYY]. Variables: PM2.5, PM10, NO_2, SO_2, CO and O_3. The download date, the station list and every cleaning step will be recorded so that the analysis can be repeated. No human participants are involved.

3.2 Cleaning

Zero, negative and repeated constant readings will be flagged and treated as missing. A day will be kept only if it meets a completeness rule fixed with the supervisor before analysis [state the

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rule]. Short gaps will be [left as missing / interpolated, with the method named], and the share of missing days per station will be reported.

3.3 Analysis

Objective 1: station-wise mean, median, standard deviation, minimum, maximum and the count of days above 60 µg/m^3. Objective 2: principal component analysis on the correlation matrix of the standardised pollutant variables; eigenvalues, proportion of variance explained, a scree plot and component loadings; the number of components retained will be decided by [the eigenvalue-greater-than-one rule and the scree plot] and the decision explained. Objective 3: the Box and Jenkins approach: stationarity checked with the augmented Dickey-Fuller test and differencing where needed; candidate orders read from the autocorrelation and partial autocorrelation functions; models compared by AIC; residuals checked with the Ljung-Box test; the last [90] days held out, and forecasts compared by root mean square error and mean absolute error. Objective 4: monthly means and box plots by month.

3.4 The two models in brief

Principal component analysis. Let X be the n x p matrix of standardised daily readings, with n days and p pollutant variables, and let R be its correlation matrix. The principal components are the eigenvectors of R, ordered by their eigenvalues; the k-th component score of a day is the inner product of that day's standardised readings with the k-th eigenvector, and the k-th eigenvalue divided by p is the share of total variance that component carries. Because the variables are measured in different units, the correlation matrix rather than the covariance matrix will be used.

ARIMA. If y_t is daily PM2.5 and w_t is y_t differenced d times, an ARIMA(p, d, q) model writes w_t as a linear combination of its own p past values and q past random shocks plus a current shock. The orders p, d and q will not be fixed in advance; they will be chosen from the data by the steps in 3.3, and every model tried will be reported, including the ones rejected.

3.5 Checks on the method

Results will be checked in three ways: the component loadings will be compared across two halves of the study period to see whether the structure is stable; forecasts will be judged only on days the model has not seen; and every table in the report will be reproducible from the attached code and the recorded download.

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3.6 Tools

Python 3 with pandas and NumPy for data handling, statsmodels for the ARIMA models and tests, and matplotlib for figures [or the equivalent in R]. The code will be kept with version numbers and attached to the report as an appendix, so that the results can be checked.

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4. Utility and scope of the work

The study shows how standard statistical tools describe air quality at the level of one city, using data that any learner can obtain. The station-wise exceedance counts and the components found by principal component analysis may help a reader see which pollutants rise and fall together in [City], and the forecast comparison shows what a purely univariate model can and cannot do.

For the learner, the project joins three parts of the programme in one piece of work: data handling and programming, multivariate analysis, and time series modelling. The finished report will document each step so that another reader with the same download can reach the same numbers.

The scope is limited in four ways. The data is secondary and depends on the quality of the station readings. A few fixed stations do not represent the whole city. Missing days reduce the effective sample. ARIMA uses only the past of the series and ignores weather, which is known to affect particulate levels. These limits will be stated in the report.

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5. Future directions for investigation

The work can be extended by adding temperature, wind speed and humidity as explanatory variables in a regression model with ARIMA errors; by comparing ARIMA with methods from MMTE-007 Soft Computing and Applications; by estimating values between stations with spatial interpolation; and by repeating the analysis for [another city] to see whether the same components appear.

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6. Plan of work

Stage	Work	Planned by
1	Proposal and Form-A finalised with the supervisor	[Month YYYY]
2	Data download and cleaning	[Month YYYY]
3	Descriptive analysis and principal component analysis	[Month YYYY]
4	ARIMA modelling and forecast comparison	[Month YYYY]
5	Report writing, supervisor review, Form-B	[Month YYYY]

Dates are yours to set with your supervisor. The plan above is not an IGNOU schedule.

References

Box, G.E.P., Jenkins, G.M., Reinsel, G.C. and Ljung, G.M. (2015). *Time Series Analysis: Forecasting and Control*, 5th edn. Hoboken: Wiley.

Central Pollution Control Board (2009). *National Ambient Air Quality Standards*. Notification No. B-29016/20/90/PCI-I, New Delhi, 18 November 2009.

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Hyndman, R.J. and Athanasopoulos, G. (2021). *Forecasting: Principles and Practice*, 3rd edn. Melbourne: OTexts.

Jolliffe, I.T. (2002). *Principal Component Analysis*, 2nd edn. New York: Springer.

Seabold, S. and Perktold, J. (2010). Statsmodels: econometric and statistical modeling with Python. *Proceedings of the 9th Python in Science Conference*, 92 to 96.

Sharma, D. and Mauzerall, D. (2022). Analysis of air quality data in India between 2015 and 2019. *Aerosol and Air Quality Research*, 22, 210204. https://doi.org/10.4209/aaqr.210204

[Add the city or regional studies you have read in full.]

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Your real proposal travels with Form-A, signed and dated by you and your supervisor. Signatures belong on Form-A, not on this sample.