Read this page first

This file is a **study reference** for learners of the IGNOU M.Sc. (Applied Statistics), programme code MSCAST, who have opted for MSTP-011 Dissertation/Project Work. It shows how one synopsis can be laid out under the headings of section 6 of the *Handbook on Dissertation/Project Work (MSTP-011)*, School of Sciences, IGNOU, November 2024. It is not a synopsis for you to submit.

Why you must not submit it. Section 6 of the Handbook says the synopsis must be written by the learner under the guidance of the supervisor, must not be copied from any other learner or source, and that a synopsis containing copied material will be summarily rejected. Copying this file, even with changes, would put your synopsis at that risk.

What the square brackets mean. Every item in [square brackets] is for your own facts: your state, your period, your figures, your supervisor and the recent studies you read yourself. Nothing in this file is data. No result, figure or finding about any state has been filled in, because findings can only come from your own analysis.

How it was prepared. The ignouproject.com editorial desk (Shri Chakradhar Publication Pvt. Ltd., New Delhi) prepared this file with AI assistance, from the MSTP-011 Handbook (November 2024) and the sources listed in section 8, and checked it in a separate review pass. ignouproject.com is independent and is not affiliated with IGNOU.

Length. The Handbook asks for a synopsis of about 15 to 20 pages or about 4,000 words, typed on A4 in Times New Roman 12 point with 1.5 line spacing, spiral-bound. This file is shorter on purpose: the review of literature and the data description are left for you to write.

What goes in the envelope (Handbook section 7, in this order):

- (i) Proforma for Approval of Dissertation/Project Work Synopsis (Appendix-I)
- (ii) Format for Synopsis Evaluation (Appendix-II)
- (iii) Guidelines for Synopsis Evaluation (Appendix-III)
- (iv) Consent letter of the guide (Appendix-IV)
- (v) Bio-data of the guide (Appendix-V); the note on Appendix-I says the signed bio-data must be enclosed even when the supervisor is an MSCAST academic counsellor
- (vi) The synopsis, two copies (one for approval, one for record)
- (vii) Acknowledgement for Synopsis Submission (Appendix-VI)

Two printing slips to ask about. Appendix-III, the evaluator's guidelines you enclose, calls MSTP-011 a course of "MSc Geoinformatics" and says the research needs remote sensing data and geospatial tools; the bio-data form (Appendix-V) asks for experience in Geoinformatics. These lines appear to be carried over from another School of Sciences handbook; a statistics topic like this one does not use remote sensing data. The Handbook also says two copies of the synopsis in section 7 but one copy in FAQ 7. Confirm both points with your supervisor or at mscast@ignou.ac.in before posting.

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Post it by registered or speed post to the Programme Coordinator, MSCAST Programme, Discipline of Statistics, School of Sciences, Block D, IGNOU, Maidan Garhi, New Delhi 110068 (Handbook section 7 and point 4 of section 14), and keep a copy.

SAMPLE FOR STUDY REFERENCE
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SHORT-TERM FORECASTING OF DAILY PEAK ELECTRICITY DEMAND IN [STATE]: A COMPARISON OF SARIMA, EXPONENTIAL SMOOTHING AND REGRESSION WITH TEMPERATURE, [YEAR] TO [YEAR]

SYNOPSIS OF DISSERTATION/PROJECT WORK (MSTP-011)

Submitted to

INDIRA GANDHI NATIONAL OPEN UNIVERSITY, NEW DELHI

for the degree of

M.Sc. APPLIED STATISTICS (MSCAST)

Learner	[Full name] Enrolment No.: [ ]
Supervisor	[Name], [Designation], [Department and institution]
Study Centre	[Name and code]
Regional Centre	[Name and code]
University	Indira Gandhi National Open University (IGNOU), Maidan Garhi, New Delhi
Date of submission	[ ]

School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi 110068

Layout follows the title page items in section 6 and the cover specimen in Annexure-A of the Handbook. The Handbook asks for the University name with its logo; this study file carries no logo.

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1. Introduction

Electricity demand in an Indian state rises and falls with the hour, the day of the week, the season, festivals and the weather. State load despatch centres plan generation and power purchase a day or more in advance, so an error in tomorrow's expected peak has a direct cost: an under-forecast means a scramble for short-term power or load shedding, and an over-forecast means paying for capacity that is not used. Grid Controller of India Limited (Grid-India) publishes a Daily Power Supply Position (PSP) report that records, for the previous day, the demand met at all-India, regional and state level.

Statement of the problem. This study asks how accurately the daily peak demand met in [State] can be forecast one to seven days ahead with three families of statistical models, and whether adding daily maximum temperature to a regression model improves on purely time-series models. The research problem is statistical: choosing and validating a forecasting model for a series with trend, weekly seasonality and annual seasonality.

Why it matters in Applied Statistics. The problem brings together time series decomposition, stationarity testing, model identification, regression with correlated errors and the formal comparison of forecast accuracy, all on a public, real data set. It applies what MST-014 (Statistical Quality Control and Time Series Analysis) and MST-017 (Applied Regression Analysis) teach, using R as practised in the MSTL lab courses.

Motivation. [Write two or three sentences of your own: why this state, why this period, and any link to your work.]

2. Review of Literature

The review will be written as continuous discussion, not as bullet points, and will cite recent studies, as Appendix-III of the Handbook asks. It will have two strands.

Methodological strand. Box, Jenkins, Reinsel and Ljung (2015) set out the identification, estimation and diagnostic checking cycle for ARIMA and seasonal ARIMA models. Hyndman and Khandakar (2008) describe automatic algorithms for exponential smoothing state space (ETS) and ARIMA models implemented in the R package *forecast*, which this study will use. Hyndman and Athanasopoulos (2021) treat dynamic regression, in which a regression on external predictors such as temperature is fitted with ARIMA errors, and the evaluation of forecasts on a test set. Hyndman and Koehler (2006) compare accuracy measures and propose the mean absolute scaled error (MASE), which can compare models across series. Diebold and Mariano (1995) give a test of whether two forecasts differ in accuracy.

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Empirical strand. [Summarise 8 to 12 studies, published mostly in the last ten years, that forecast electricity demand or load in India or in a comparable climate. For each, note the data, the horizon, the models compared and the accuracy measure used. Read every study yourself and cite only what you have read.]

Gap. [State the gap you found, for example that few published studies use [State]'s daily PSP series, or compare these model families on the same hold-out period with a formal accuracy test. Write it only after your own reading supports it.]

3. Rationale of the Study

The study is justified on three grounds, each to be supported by citations from your review. First, daily peak demand in [State] is published daily and openly, so the study is feasible within the 240 hours the Handbook sets for the 8-credit project. Second, temperature is widely treated as a driver of electricity demand in hot months [cite]; testing whether it improves short-term forecasts for [State] is a specific, answerable question. Third, the comparison uses standard, replicable methods, which section 6 of the Handbook asks the methodology to be.

4. Objectives and Hypotheses

- To describe the trend, weekly pattern and annual pattern of daily peak demand met in [State] during [period].
- To fit seasonal ARIMA, ETS and regression-with-ARIMA-error models with daily maximum temperature, and to compare their one-day and seven-day-ahead forecast accuracy on a hold-out period.
- To estimate the relationship between daily maximum temperature and daily peak demand after allowing for day-of-week effects.
- To test whether the forecast accuracy of the best model differs from that of a seasonal naive benchmark.

H01: Daily maximum temperature has no significant effect on daily peak demand met after day-of-week effects and ARIMA errors are allowed for.

H02: There is no significant difference in one-day-ahead forecast accuracy between [the selected model] and the seasonal naive benchmark (Diebold-Mariano test).

5. Research Methodology

5.1 Research design

Analytical and quantitative, using secondary time series data. No primary survey is involved.

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5.2 Data collection (secondary data)

- Daily peak demand met (MW) for [State] from the Grid-India Daily PSP reports (report.grid-india.in), section C, Power Supply Position in States, for [start date] to [end date]. [Confirm the exact column name printed in the reports for your period.]
- Daily maximum temperature for [the grid points covering the state's main load centres, or a named IMD station] from the India Meteorological Department gridded daily temperature data (Srivastava, Rajeevan and Kshirsagar, 2009). [Confirm which years are available for your period; the IMD download page notes that recent years rest on fewer stations.]
- A calendar of national and state holidays for [State] for the same period, from [source].

5.3 Population, sample and its justification

The population is every day in [period]. All days are used (complete enumeration, n = [number of days]); no sampling is needed. The last [365] days will be held out as a test set and the earlier [n minus 365] days used for fitting, so that each model is judged on a full year of seasons it has not seen. [Explain any missing days and how they are treated.]

5.4 Variables and operational definitions

Variable	Operational definition	Source
Peak demand (Y)	Peak demand met in [State] on day t, in MW, as printed in the PSP report for that day	Grid-India Daily PSP
Temperature (X1)	Daily maximum temperature, degrees Celsius, averaged over [grid points or station]	IMD gridded data
Cooling term (X2)	max(0, X1 minus [threshold]) degrees Celsius; threshold chosen from the data and justified	Derived
Day of week (D)	Six indicator variables, Sunday as base	Calendar
Holiday (Hd)	1 on a listed holiday, else 0	[Source]

5.5 Statistical tools and techniques

- Descriptive statistics, time plots and STL decomposition of the series.
- Stationarity checks with the Augmented Dickey-Fuller and KPSS tests, and differencing where needed.
- Seasonal ARIMA, identified from ACF and PACF plots and compared with the automatic selection of Hyndman and Khandakar (2008); weekly seasonality with period 7.
- ETS models selected by AICc.

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- Regression of Y on X1 or X2, D and Hd with ARIMA errors (dynamic regression), to test H01.
- Residual diagnostics, including the Ljung-Box test.
- Accuracy on the test set by MAE, RMSE, MAPE and MASE (Hyndman and Koehler, 2006), and the Diebold-Mariano test (Diebold and Mariano, 1995) for H02.

5.6 Software

R with the *forecast* and *tseries* packages for modelling; Python (pandas) for downloading and cleaning the daily reports. Section 6 of the Handbook names R and Python.

5.7 Ethics and data use

The study uses only published, aggregate data. Each source will be cited with its date of access, and no figure will be entered that was not read from a source or computed from the data. Data collection begins only after the synopsis is approved (Handbook, note 2 under section 6).

6. Work Plan and Timeline

Weeks	Activity	Dates
1 to 4	Review of literature; finalise variables with the supervisor	[ ] to [ ]
5 to 8	Download, clean and merge PSP, temperature and holiday data	[ ] to [ ]
9 to 12	Model fitting, diagnostics, test-set evaluation, hypothesis tests	[ ] to [ ]
13 to 16	Writing chapters 1 to 6	[ ] to [ ]
17 to 20	Revision with the supervisor; binding and submission	[ ] to [ ]

The five blocks follow the example work plan printed in section 6 of the Handbook. Fill in dates that fit your batch: the Handbook's timeline gives 31 May for July-batch reports and 30 November for January-batch reports.

7. Limitations

- Peak demand met is not the same as unrestricted demand; on days with shortage, met demand understates demand. [Check the shortage column for your period and say how many days are affected.]
- Gridded temperature averages over a grid cell and may differ from the temperature in the main cities.
- The study forecasts one state's series; conclusions may not carry to other states.

8. References

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Box, G. E. P., Jenkins, G. M., Reinsel, G. C., & Ljung, G. M. (2015). *Time series analysis: Forecasting and control* (5th ed.). Wiley.

Diebold, F. X., & Mariano, R. S. (1995). Comparing predictive accuracy. *Journal of Business & Economic Statistics, 13*(3), 253-263.

Grid Controller of India Limited. ([Year]). *Daily PSP report* [Data set, reports for [start date] to [end date]]. https://report.grid-india.in/

Hyndman, R. J., & Athanasopoulos, G. (2021). *Forecasting: Principles and practice* (3rd ed.). OTexts. https://otexts.com/fpp3/

Hyndman, R. J., & Khandakar, Y. (2008). Automatic time series forecasting: The forecast package for R. *Journal of Statistical Software, 27*(3). https://doi.org/10.18637/jss.v027.i03

Hyndman, R. J., & Koehler, A. B. (2006). Another look at measures of forecast accuracy. *International Journal of Forecasting, 22*(4), 679-688.

Indira Gandhi National Open University, School of Sciences. (2024). *Handbook on dissertation/project work (MSTP-011), M.Sc. (Applied Statistics)*. IGNOU.

Srivastava, A. K., Rajeevan, M., & Kshirsagar, S. R. (2009). Development of a high resolution daily gridded temperature data set (1969-2005) for the Indian region. *Atmospheric Science Letters, 10*(4), 249-254. https://doi.org/10.1002/asl.232

[Add every empirical study you cite in section 2, in alphabetical order.]

References follow APA style in alphabetical order, as sections 6 and 14 of the Handbook ask.

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