

Roll No. ....

Total Pages : 03

BT-4/M-24

44217

BAYESIAN DATA ANALYSIS  
BS-AIDS-202A

Time : Three Hours]

[Maximum Marks : 75

**Note :** Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

**Unit I**

1. (a) What are the fundamental principles of the Bayesian approach to probability and how does it differ from the classical approach ? Discuss the key concepts underlying Bayesian inference. **10**
- (b) Describe the basics of probability theory within the Bayesian framework. **5**
2. Elaborate various infinite models, such as hierarchical models and non-parametric models, in detail. **15**

**Unit II**

3. (a) Explain the concept of graphical posterior predictive checks. How are graphical methods used to visually assess the performance of Bayesian models in predicting observed data ? **7**



- (b) In what contexts is Bayesian decision theory applied, and how does it differ from classical decision theory ? Discuss the key principles and applications of Bayesian decision theory. 8
- 4. (a) Compare and contrast information criteria and cross-validation as methods for model comparison in Bayesian statistics. 7
- (b) Explain how regression predictions are utilized in decision-making. Provide examples of how Bayesian regression models can inform decision-making processes in various fields such as healthcare, finance, or marketing. 8

### Unit III

- 5. (a) Explain the process of finding marginal posterior modes using Evolutionary Monte Carlo (EMC). 7
- (b) Discuss the implementation of Gibbs Sampling in Bayesian analysis, using examples in R. What are the advantages and limitations of using Gibbs Sampling in practice ? 8
- 6. (a) What is Hamiltonian Monte Carlo (HMC), and how does it differ from traditional Monte Carlo methods ? Discuss the advantages of using HMC in Bayesian analysis. 8

- (b) Describe the concept of posterior modes and their importance in Bayesian inference. How can normal and related mixture approximations be used to approximate posterior modes ? 7

#### Unit IV

7. (a) How does Bayesian analysis enhance our understanding of the classical regression model, and what are the key differences between Bayesian and classical approaches in regression analysis ? 7
- (b) Describe the importance of weakly informative priors in logistic regression models and their role in improving model performance and inference. 8
8. Elaborate in detail : 15
- (i) Parametric nonlinear models
  - (ii) Gaussian process models
  - (iii) Dirichlet process models.