ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

No. Acd./ \№2ᵀ /IAPC-70   Dated: April 16 , 2019

Head, Department of Mathematics
(through e-mail)

      The IAPC in its 70ᵗʰ meeting held on 02.04.2019 vide **Item No. 70.2.1** considered and approved the proposal of Department of Mathematics to introduce a new course **MAN-528 "Simulation Techniques"** as PEC for their programs Integrated M.Sc. (Applied Maths) and M.Sc. (Mathematics). The approved course is attached as **Appendix-A**.

      Further action may kindly be taken accordingly.

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Assistant Registrar (Curriculum)

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Encl: as above

Copy to (through e mail):-
1. All faculty
2. All Head of Departments/Centres
3. Dean Academic Affairs
4. Associate Dean of Academic Affairs(Curriculum)
5. Channel I/ Academic webpage of iitr.ac.in

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE: **Mathematics Department**

1. Subject Code: **MAN-528**   Course Title: **Simulation Techniques**
2. Contact Hours: **L: 3**   **T: 0**   **P: 2**
3. Examination Duration (Hrs):   **Theory   3**   **Practical   0**
4. Relative Weightage: **CWS   10-25   PRS   25   MTE   15-25   ETE   30-40   PRE   0**
5. Credits: **4**   6. Semester: **Autumn/Spring**   7. Subject Area: **PEC**
8. Pre-requisite: Knowledge of basic probability and statistics and any programming language
9. Objective: To impart knowledge of some simulation techniques with applications (particularly in finance)

10. Details of Course:

Sl.No.	Contents	Contact Hours
1.	Pseudo-random number generators, generator based on linear recurrences, add-with-carry and subtract-with-borrow generators, non-linear generators, theoretical tests for PRNGs based on recurrence modulo 2, statistical tests	3
2.	General sampling method, inverse transform method, acceptance-rejection method, composition, convolution and other useful identities, generating variates from standard distributions such as normal, gamma, exponential, beta, Poisson, binomial, normal random vector, Box-Muller method	11
3.	Variance reduction techniques, control variate method, antithetic variate method, importance sampling, stratified sampling, Latin hypercube sampling, moment-matching method, conditional Monte Carlo	12
4.	Quasi-Monte Carlo method, basic principles, lattices, digital nets and sequences, solo sequence, Faure sequence, Niederreiter sequence	10
5.	Application in finance, European option pricing under log normal model, randomised quasi-Monte Carlo American option pricing, estimating sensitivities and percentiles	6
	Total	**42**

11. Suggested Books:

S.No.	Name of the Authors/Books/Publishers	Year of Publication
1.	G. S. Fishman, "Monte Carlo: Concepts, Algorithms, and Applications", Springer	1996
2.	P. Glasserman, "Monte Carlo Methods in Financial Engineering", Springer	2003

3.	C. Lemieux, "Monte Carlo and Quasi-Monte Carlo Sampling", Springer	2009
4.	J. C. Hull, "Options, Futures and Other Derivatives", Prentice Hall	2002
5.	P. E. Kloeden and E. Platen, "Numerical Solution of Stochastic Differential Equations", Springer-Verlag	1992
6.	A. M. Law and W. D. Kelton, "Simulation Modeling and Analysis", McGraw-Hill, inc.	1991
7.	Sheldon Ross, "A First Course in Probability", Pearson	2013