



**University School of Basic & Applied Sciences**  
**GGs Indraprastha University**  
Sector 16-C, Dwarka, New Delhi-110 078


No.F.GGSIPU/USBAS/2016/13565

Dated: 19.08.2016

**Subject: Course work of Ph.D Programme for the academic session 2016-17.**

This has reference to Notice No.GGSIPU/DRC/Ph.D/Adm./2016/1838 dated 10.08.2016. As per the Clause 4.4 of new Ph.D Ordinance-12, the information regarding the course work of Ph.D Programme for the academic session 2016-17 are as under:

1.	Courses being offered: Ph.D. in Physics, Chemistry & Mathematics in USBAS.	:	1. Introduction to MATLAB and Computational Methods (CWCHE-151)- 6hrs 2. An Introduction to Fuzzy Mathematics (FM)- 3 hrs 3. Synthesis & Isolation of Air Sensitive Compounds (AS)-3 hrs 4. Synthesis of organo Phosphorus Compounds (OP)- 3 hrs
2.	Number of credits	:	3 credits each
3.	Whether offered during weekdays or weekends	:	Weekdays
4.	Name of the School offering the said course	:	University School of Basic and Applied Sciences
5.	Name of the teaching faculty	:	1. Dr. Tapan K. Jain Dr. Anjana Bagga 2. Dr. Abha Aggarwal 3. Dr. Arif Ali Khan 4. Dr. Arif Ali Khan
6.	Classroom	:	BCR-011

  
(Prof. Satish Manocha)  
Dean, USBAS

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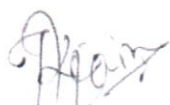
1. Director, Research and Consultancy.
2. Head, UITS-To upload on the University website.
3. Notice Board

Time Table Ph.D Course work for 2016-17 (USBAS)

	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00
Monday		FM/Dr. Abha/B SR-011				AS/Dr. Arif/BSR- 011	AS/Dr. Arif/BSR- 011	
Tuesday			CWCHE- 151/Dr. Anjana/BT L-401	CWCHE- 151/Dr. Anjana/BT L-401	CWCHE- 151/Dr. Anjana/BT L-401	CWCHE- 151/Dr. Tapan/BT L-401	FM/ Dr. Abha /BSR-011  CWCHE- 151/Dr. Tapan/BT L-401	CWCHE- 151/Dr. Tapan/BT L-401
Wednesday							AS/Dr. Arif/BCR- 404	OP/Dr. Arif/BSR- 011
Thursday								
Friday							FM/ Dr. Abha /BCR-313  OP/Dr. Arif/BSR- 011	OP/Dr. Arif/BSR- 011



Dr. Arif Ali Khan



Dr. Tapan K. Jain



Prof. S. Manocha

Syllabus of above mentioned  
papers is enclosed





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**Paper Name: Introduction to Matlab and Computational methods**  
**LAB COURSE (6 Hours) , 3 Credits**  
**Exam will be Lab based**

Introduction to the Matlab programming language, Operations in Matlab: basic mathematical operations with matrices, arrays, etc. Plotting with Matlab: line plots, 1-D, 2-D, 3-D, meshgrid, labeling axes, legends, importing and plotting data files in Matlab; Numerical methods for Solving Ordinary Differential Equations (ODEs): The Euler method, Programming in Matlab to solve 1<sup>st</sup> order and 2<sup>nd</sup> order ODEs by Euler method; Solving ODEs using inbuilt matlab solvers; Using direct matlab solvers for root finding; Using direct Matlab solvers for integration; Introduction to Monte Carlo methods-random numbers, Monte Carlo Integration;

Example Applications [This list may be updated/modified to include related application from time to time]

**Physics & Mathematics**

1. **Plotting** (a) Eigenvalues & Eigenfunctions for Particle in a Box – 1D & 2D; (b) Hydrogen atom wavefunctions
2. **ODE's – examples-** (a) Simple, damped and driven Harmonic Oscillator; (b) Van der Pol Oscillator; (c) Radioactive Decay; (d) LCR Circuit; (e) Schrodinger equation in 1D (f) Coupled ODEs – The Lorenz Equations
3. **Monte Carlo methods**  
(a) Simulate coin toss, die roll etc. using Matlab's inbuilt commands; (b) Estimating the value of "pi" using random numbers on a circle & sphere; (c) Monte Carlo Integration
4. (a) Some examples from linear algebra and matrices; (b) root finding (b) Simple Fractals (c) polynomial fit & exponential fit

**Chemistry**

1. **Plotting** (a) Eigenvalues & Eigenfunctions for Particle in a Box – 1D & 2D; (b) Hydrogen atom wavefunctions
2. **ODE's – examples-**(a) Schrodinger equation in 1D; (b) Kinetics of Oscillatory reactions.
3. Calculation of  $\pi$ - electron Huckel Molecular orbitals of molecules Butadiene, Benzene, Allyl radical, Pyridine, Aniline, Anilinium ion, toluene. HUMO, LUMO calculation of molecules (Linear, Cyclic, effect of Hetero atom, N, O, Cl, Br).
4. Application of eigenvalues like Fast Reaction kinetics, HUMO calculation, normal coordinate analysis for finding normal modes of vibrations of simple molecules.
5. Curve fitting of data points. Analysis of UV-Vis-NIR spectra (like peak detection, peak area, differential plots for detection of peaks)

**References**

1. Rudra Pratap: Getting started with Matlab [Oxford Univeristy Press],2006
2. Stephen J. Chapman: for engineers, 2004
3. Balagurusamy, Numerical Methods [Tata McGraw Hill],1999

*Obh*

Passed by BOS Meeting held on August 27, 2015

Passed by Academic sub committee in the meeting held on Sept 17, 2015.

*Aravind*

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A.



Duality in linear programming, two person zero-sum matrix games, linear programming and matrix game equivalence, two person non-zero sum (bi-matrix) games, quadratic programming and bi-matrix game, constrained matrix games.

## 2. Fuzzy sets

Introduction, basic definitions and set theoretic operations,  $\alpha$ -Cuts and their properties, convex fuzzy sets, Zadeh's extension principle, fuzzy relations, triangular norms (t-norms) and triangular conorms (t-conorms).

## 3. Fuzzy numbers and fuzzy arithmetic

Introduction, interval arithmetic, fuzzy numbers and their representation, arithmetic of fuzzy numbers, special types of fuzzy numbers and their arithmetic, ranking of fuzzy numbers.

4. Decision Making in fuzzy environment: Fuzzy decisions, Fuzzy linear programming, Fuzzy game theory

## References

- (1) Bector, C.R. and Chandra, S., Fuzzy Mathematical Programming and Fuzzy Matrix Games, Springer, 2005.
- (2) Klir, G.J. and Yuan, B., Fuzzy Sets and Logic: Theory and Applications, Prentice Hall India, 2004.
- (3) Zimmermann, H.-J., Fuzzy Sets Theory and its Applications, 4th edition, Springer, 2001.
- (4) G.Owen, Game Theory, Academic Press, San Diego, 1995.



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Syllabus for Ph.D. Course Work in Chemistry

Credit :3 Lectures: 40

Synthesis, Isolation and Purification of air sensitive compounds

1. Solvent Purification: Distillation of organic solvents and distillation under vacuum and use of nomograph to establish b. p. of a solvent/ compound at various pressures, common drying agents, design of apparatus for distillation under inert atmosphere of dry nitrogen or argon gas. (10 hrs)
2. Schlenk Techniques: Synthesis of air sensitive compounds and manipulation of air sensitive reactions. Designs of Schlenk Apparatus- round bottom Schlenk flask, Schlenk tubes, Young tubes. (10 hrs)
3. Purification of air sensitive compounds: Recrystallization at room temperature / low temperature under inert atmosphere, washing/ removal of impurities from unstable compounds at low temperature. (10 hrs)
4. Chromatography Techniques: low temperature column chromatography, design of column for low temperature chromatography. (10 hrs)

**BOOK RECOMMENDED**

1. E.Heftmann, A laboratory handbook of chromatography, New - York, 1975.
2. H.H.Willard, L.L.Merritt and J.A.Dean, Instrumental methods of analysis, Van Nostrend Reinhold, New York, 1974.
3. K. L. Williamson, Organic Experiments, Houghton Mifflin Company, New York, 2007.
4. J. C. Gilbert and S. F. Martin, Experimental Organic Chemistry, Harcourt College Publisher, New York, 1998.
5. Paul R. Jenkins, Organometallic Reagents in Synthesis, Oxford, 1992.



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Syllabus for Ph.D. Course Work in Chemistry

Credit :3 Lectures: 40

Synthesis and application of organophosphorus compounds

1. **Organometallic Reagents in Synthesis:** Metallated saturated hydrocarbons, metallated alkenes, metallated alkynes, metallated aromatic compounds, metallated heterocyclic compounds and heteroatom stabilised organometallic reagents. (10 hrs)
2. **Chemistry of Phosphorus (I) Compounds:** Phosphinidenes, synthesis and stabilization of phosphinidenes, singlet and triplet phosphinidene, insertion reactions of phosphinidenes, reagents to generate phosphinidenes. (10 hrs)
3. **Chemistry of Phosphorus (III) Compounds:** Phosphines/ Phosphanes, Phosphaalkenes, Phosphaalkynes, Phosphazenes, Phosphites, Arbuzov reactions. (10 hrs)
4. **Chemistry of Phosphorus (V) Compounds:** Phosphine chalcogenides, Phosphorus ylides, Wittig reactions, Arbuzov reactions, phosphonates. (10 hrs)

**BOOK RECOMMENDED**

1. Paul R. Jenkins, Organometallic Reagents in Synthesis, Oxford.
2. Oleg I. Kolodiaznyi, Phosphorus Ylides, Wiley-VCH, Weinheim, 1999.
3. F. Mathey, "Multiple Bonds and Low Coordination in Phosphorus Chemistry", edited by M. Regitz and O. J. Scherer (Georg Thieme Verlag, New York, 1990).
4. K. B. Dillon, F. Mathey, and J. F. Nixon, "Phosphorus: the Carbon Copy", (Wiley, Chichester, 1998).

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