

**ANNUAL FOUNDATION SCHOOL, I.I.T. Kanpur. Dec3-28,2007**

***List of Teachers:***

Algebra: Arvind Lal (AKL), C.S. Dalawat(CSD)\*

Analysis: P. Mohanty (PM), S.K. Ray (SKR), P. Shunmugaraj (PS),  
S. Madan(SM), Shivaji Ganesh(SG)\*\*

Topology: N. Nilkanthan (NN)

Geometry: G. Santhanam(GS)

\* From HRI; \*\* From IITB.

**TIME – TABLE**

DATE	9.30-11.0 0		11.30-13.00	14.30-15.30	16.00-17.00
3/12 Mon	Inaug	AKL1	GS 1	SKR 1	Geo(T1)
4/12 Tue	AKL 2		GS 2	SKR 2	Geo(T2)
5/12 Wed	AKL 3		GS 3	Alg(T1)	Int(T1)
6/12 Thu	AKL 4		GS 4	SKR 3	Geo(T3)
7/12 Fri	AKL 5		GS 5	Int(T2)	Geo(T4)
8/12 Sat	SKR 4		GS 6	Alg(T2)	T

DATE	9.30-11.0 0	11.30-13.00	14.30-15.30	16.00-17.00
10/12 Mon	SKR 5	GS 7	Int(T3)	Geo(T5)
11/12 Tue	AKL 6	GS 8	Alg(T3)	Int(T2)
12/12 Wed	AKL 7	GS 9	Alg(T4)	Geo(T6)
13/12 Thu	AKL 8	GS 10	Alg(T5)	UM
14/12 Fri	AKL 9	PSR 1	Alg(T6)	Geo(T7)
15/12 Sat	AKL 10	PSR 2	T	T

DATE	9.30-11.00	11.30-13.00	14.30-15.30	16.00-17.00
17/12 M	NN 1	PSR 3	Alg(T6)	fa(T1)
18/12 Tu	NN 2	ODE 1	Alg(T7)	Top(T1)UM
19/12 W	NN 3	PSR 4	Fa(T2)	UM
20/12 Th	NN 4	ODE 2	Fa(T3)	UM
21/12 F	NN 5	PM 1	Top(T2)	Ode(T1)
22/12 S	PM 2	Fs (T1)	Top (T3)	Ode(T2)

DATE	9.30-11.00	11.30-13.00	14.30-15.30	16.00-17.00
24/12 M	CSD 1	ODE 3	Fs(T2)	Mod(T1)
25/12	*****	*****	*****	*****
26/12 W	CSD 2	SM 3	Top(T4)	Mod(T2)
27/12 Th	CSD 3	ODE 4	Ode(T3)	Mod(T3)
28/12 F	CSD 4	SM 4	Fs (T3)	UM & Closing

**\*Books for distributing to candidates:**

1. W. Rudin. Real and Complex Analysis.
2. I.M. Singer and J.A. Thorpe. Lecture Notes on Elementary Topology and Geometry.
3. S. Lang. Algebra.

## Syllabus for AFS-I, December 2007 at IIT Kanpur.

### 1. Algebra

#### **Galois Theory. Speaker: Arvind Lal (15h + 7)**

Basics. Splitting fields, separable and normal extensions. Algebraically closed fields, Fundamental theorem of Galois Theory. Galois groups of cubics and quartics. Cyclotomic extensions, applications to number theory. Galois solvability criterion, existence of Galois extensions with given abelian group. Finite fields with applications to quadratic reciprocity. Norms and traces.

#### **Modules over PIDs: Chandan S. Dalawat (6h + 3)**

The Basic Theory, structure Theorem for finitely generated abelian groups and canonical forms of Matrices.

#### **Books:**

1. M. Artin, Algebra. Prentice Hall of India, 1994.
2. S. Lang, Algebra, 3<sup>rd</sup> edition, Addison Wesley 1993.
3. J. A. Gallian, Contemporary Abstract Algebra. Narosa Publishers 1999
4. N Jacobson, Basic Algebra I, Hindustan Publishing, 1991

### 2. Analysis

#### **Measure and Integration. Speaker: S.K. Ray (6h + 3)**

Reimann Integration, a review. Lebesgue measure on  $\mathbb{R}^n$ . Abstract Integration and the convergence theorems.  $L^p$  spaces and applications.

#### **Books:**

1. W. Rudin, Real and Complex Analysis. Tata McGraw-Hill.

#### **Functional Analysis. Speaker: P. Shunmugaraj(6h + 3)**

Normed linear spaces, Hilbert spaces. The main theorems of Functional Analysis. Unconditional and absolute convergence of series in a NLS. Geometry of Banach Spaces.

#### **Books:**

1. B.V. Limaye Functional Analysis. New Age Int.

#### **Fourier Analysis. Speakers: P. Mohanty and S. Madan(6h + 3)**

Fourier Series, Reimann Lebesgue lemma, Convergence of Fourier Series, Convolutions, approximate identities, summability. The Gibbs' phenomenon, divergent Fourier Series. The Fourier integral. Basic Theorems.

#### **Books:**

1. Y. Katznelson.

2. Douandikoetxea, J, Fourier Analysis
3. Stein, E. and Shakarchi. Fourier Analysis.

**ODE. Speaker: Shivaji Ganesh (6h + 3)**

Existence of Local solutions for first order systems, Maximal time of existence, finite time blow-up, global solutions. Gronwall inequality, continuous dependence on initial data and on the vector field on bounded intervals. Examples of Linear systems, Fundamental solutions.

**Books:**

Differential Equations, Dynamical Systems and an Introduction to Chaos. M.W.Hirsch, S. Smale and R.L. Devaney. Elsevier 2004.

### **3. Topology and Geometry**

**Differentiable manifolds. Speaker: G. Santhanam(15h + 6)**

Smooth maps, bump functions, smooth partitions of identity. Inverse and implicit function theorems. Examples. Manifolds, tangent spaces, immersions submersions, regular and critical values, Sard's theorem. Applications. Curves and Surfaces in  $\mathbb{R}^2$  and  $\mathbb{R}^3$

**Books:**

1. M.P. do Carmo. Differential Geometry of Curves and Surfaces. Prentice Hall 1976.
2. Gray, A. Modern Differential Geometry of Curves and Surfaces with MATHEMATICA, CRC Press 1998.
3. S. Kumaresan. A Course in Differential geometry and Lie Groups. TRIM Series, HBA 2001.
4. Pressley, A. Elementary differential geometry. Springer 2005.

**Algebraic Topology. Speaker: N. Nilkanthan(7.5h + 4)**

Covering Spaces, Fundamental groups, simplicial complexes. Simplicial Homology, some applications.

**Books:**

1. Singer, I.M. and Thorpe, J.A. Lecture Notes on elementary topology and geometry. UTM Springer