King Saud University
Department of Mathematics
Semester II: 1428-1429
COURSE OUTLINE FOR
MATH 570: TOPOLOGY and CALCULUS in $\Re^n$(3-credit units)

Reference Books:

1. Topology by James R. Munkres
2. Calculus on Manifolds by M. Spivak
3. Differentiable Manifolds by Y. Matsushima
5. Introduction to Differentiable Manifolds and Riemannian Geometry by W. M. Boothby

Prerequisite: Math 375: Introduction to Topology(3+1) credit-hours

A. TOPOLOGY

*__REVIEW:(Munkres, Chapter 2; Sections: 2.1-2.10)__

1. Separation axioms (Munkres, Chapter 4): $T_0 - T_2$, regular spaces, normal spaces, completely regular spaces and Urysohn lemma
2. Locally compact spaces and one-point compactification (Munkres, Chapter 3, pp.183)
3. Quotient spaces (Munkres, Chapter 2, pp.134)
a) Quotient map, quotient topology
b) Quotient topology by equivalence relation; various examples, such as, Torus, Möbius strip, Klein bottle, n-dimensional real projective spaces $\mathbf{RP}_n$
c) Criteria for quotient space to be Hausdorff, open equivalence relation, Haudorffness of the n-dimensional real projective space $\mathbf{RP}_n$
4. Connectedness (Munkres, Chapter 3)
a) Connected spaces
b) Pathconnected spaces
c) Components, pathcomponents, relation between pathcomponents and components, quasicomponents
d) Locally connected spaces, locally path connected spaces

B. CALCULUS in $\Re^n$ (Spivak, Chapters: 1 and 2)

a) Topology in $\Re^n$
b) Limits, continuity and differentiability of functions of several variables
c) Mean-Value Theorem
d) Taylor's Theorem
e) Inverse and Inplicit Function Theorems

C. DIFFERENTIABLE MANIFOLDS(Matsushima, Chapter 2)

a) Definition of topological manifolds and examples
b) Definition of smooth manifolds and examples
c) Tangent vectors and tangent spaces
d) Smooth functions on manifolds
e) Inverse and Implicit Function Theorems on manifolds