No. 2419677/2419361
Fax: 0821-2419363/2419301

e-mail : registrar@uni-mysore.ac.in
www.uni-mysore.ac.in

UNIVERSITY OF MYSORE

Estd. 1916

Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005

No.AC.2(S)/384/14-15

Dated: 28.05.2016

01-6

NOTIFICATION

Sub: Introduction of two new soft core courses namely "Modular Functions" and "Hypergeometric functions and q-series" for the III semester and IV semester M.Sc. Mathematics from the Academic Year 2016-17.

Ref: 1. Decision of the Faculty of Science & Technology Meeting held on 16.02.2016.

2. Decision of the Academic Council meeting held on 29-03-2016.

*****

The Board of Studies in Mathematics (PG) which met on 9-11-2015 has resolved to Introduce two new soft core courses namely "Modular Functions" and "Hypergeometric functions and q-series" for the III semester and IV semester M.Sc. Mathematics. (PG) as follows from the academic year 2016-17.

III Semester M. Sc Mathematics Soft Core Syllabus

Course Title: **Modular Functions** Teaching Hours: 5/week

Unit 1. Elliptic Functions

Introduction, Doubly periodic functions, Fundamental pairs of periods, Elliptic functions, Construction of elliptic functions, The Weierstrass $\wp$ function, The Laurent expansion of $\wp$ near the origin, Differential equation satisfied by $\wp$, The Eisenstein series and the invariants g_2 and g_3,The numbers e_1, e_2, e_3 The discriminant Δ, Klein's modular function $J(\tau)$, Invariance of J under unimodular transformations, The Fourier expansions of $g_2(\tau)$ and $g_3(\tau)$, The Fourier expansions of $\Delta(r)$ and $J(\tau)$.

Unit 2. The Modular group and modular functions

Mobius transformations, The modular group Γ, Fundamental regions, Modular functions, Special values of J, Modular functions as rational functions of J, Mapping properties of J, Application to the inversion problem for Eisenstein series, Application to Picard's theorem.

Unit 3. The Dedekind eta function

Introduction, Siegel's proof of Theorem 3.1, Infinite product representation for $\Delta(\tau)$, The general functional equation for $\eta(\tau)$ transformation formula , Deduction of Dedekind's functional equation from Iseki's Formula, Properties of Dedekind sums, The reciprocity law for Dedekind sums, Congruence properties of Dedekind sums , The Eisenstein series $G_2(\tau)$.

Unit 4. Congruences for the coefficients of the modular function *j*

Introduction, The subgroup $\Gamma_0(q)$, Fundamental region of $\Gamma_0(p)$, Functions automorphic under the subgroup $\Gamma_0(p)$, Construction of functions belonging to $\Gamma_0(p)$, The behavior of f_p under the generators of Γ, The function $\varphi(\tau) = \Delta(q\tau)/\Delta(\tau)$, The univalent function $\phi(\tau)$, Invariance of $\phi(\tau)$ under transformations of $\Gamma_0(q)$, The function j_p expressed as a polynomial in ϕ.

Books for Reference:

1. Tom M. Apostol, *Modular Functions and Dirichlet Series in Number Theory*, Springer - Verlag, 1976..
2. Gunning, R. C. *Lectures on Modular Forms*, Annals of Mathematics Studies, No. 48. Princeton Univ. Press, Princeton, New Jersey, 1962. MR 24 # A2664.

IV Semester M. Sc Mathematics Soft Core Syllabus

Course Title: **Hypergeometric Functions and *q*-Series.** Teaching Hours: 5/week

Unit 1. The Gauss Function

Historical introduction, The Gauss series and its convergence, The Gauss equation, The connection with Riemann's equation, Kummer's twenty-four solutions, Contiguous functions and recurrence relations, Special cases of the Gauss function, Some integral representations, The Gauss summation theorem, Another special summation theorem, Analytic continuation formulae.

Unit 2. Basic Hypergeometric Functions

Convergence of Heine series-Some simple results, Jackson's Theorem, Basic analogue of Saalschutz's Theorem, Application of Bailey's transformation to basic series, Some numerical evaluation of infinite products, Basic bilateral series, Ramanujan's ${}_1\Psi_1$ summation formula.

Unit 3. Theta Functions

Ramanujan's general theta-function and its particular cases, Theta-function identities of Ramanujan found in his Chapter 16 of his second notebook, Quintuple product identity and its applications.

Unit 4. *q*-Continued fractions

Ramanujan's cubic continued fractions, Rogers-Ramanujan continued fractions and related theta-function identities.

Books for Reference:

1. L. J. Slater, *Generalized Hypergeometric Functions*, Cambridge University Press, London, 1966.
2. H. Exton, *q-Hypergeometric Functions and Applications*, Ellis Horwood Series in Mathematics and its Application, Chichester, 1983.