

**M.Sc (AUDIOLOGY)**  
*(Revised)*

**CURRICULUM**



**REHABILITATION COUNCIL OF INDIA**  
**NEW DELHI**  
**2006**

**SYLLABUS FOR M.Sc (AUDIOLOGY)**

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I. Nomenclature: M.Sc (Audiology)

II. Admission criteria : B.Sc/BSLPA/BASLP degree from any recognized University with minimum pass percentage required as per University norms

III. Medium of instruction: English

IV. Duration of the course: 4 Semesters/2 academic years

V. Course work: Each student will pursue the course as in the enclosed course of studies

VI. Award of Degree: The respective Universities on successful completion of the requirements will award the degree.

VII. Criteria of passing: As per university rules

VIII. Attendance: 80% in theory and 90% in clinical practicum

## **REGULATIONS**

**1.0 Attendance:** Each semester shall be taken as a unit, for purpose of calculating attendance and a student shall be considered to have put in required attendance for the semester, if he/she has attended not less than 80% of the number of working periods (lectures, seminars) and 90% of clinics during each semester.

- 1.1 A candidate who is having shortage of attendance in clinical practicum shall make up this shortage by attending clinical work during vacation immediately after that semester but before commencement of the next semester.
- 1.2 A candidate who does not satisfy the requirement of attendance shall not be eligible to take the examination of the concerned semester
- 1.3 A candidate who fails to satisfy the requirement of attendance in a semester, shall rejoin the same semester

**2.0 Medium of Instruction:** The medium of instruction shall be English.

**3.0 Appearance for the Examination:** A candidate shall apply for all papers of a semester when he/she appears for the examination of that semester for the first time.

**4.0 Scheme of Examination:**

- 4.1 There shall be a University examination at the end of each semester. The duration of the theory exam is 3 hours
- 4.2 Every theory question paper shall ordinarily consist of five questions with one question for each unit. All questions are compulsory. Each question will have sections requiring both short and long answers and will have internal choice,

developed to test conceptual skills, understanding skills, comprehension skills, expression and application skills.

#### 4.3

- (i) In case of theory papers the continuous evaluation will be for 20 marks. This covers a maximum of 5 marks for attendance & 15 marks for tests, seminars, assignments etc
- (ii) For clinical practicum, continuous evaluation will be based on performance of the candidate during the semester.
- (iii) The concerned department shall notify in the first week of each semester, scheme of continuous evaluation for theory & practicals.
- (iv) At least one week prior to the last working day, continuous evaluation marks secured by the candidates shall be displayed on the notice board.
- (v) The Department council may decide to give test/seminar to candidates who absent themselves for the above, only if the council is convinced that the absence of the candidate is on valid grounds. However, the council will allow the candidate to avail this provision within the duration of that semester.
- (vi) The statement of continuous evaluation shall be sent to the Registrar(Evaluation) at least one week prior to the commencement of the particular semester examination.

#### 4.4 Practicals

- (i) In the 1<sup>st</sup> and 3<sup>rd</sup> semesters internal viva voce exam will be carried out by 2 internal examiners for 20 marks & 80 marks shall be awarded for continuous evaluation of clinical work for whole semester including clinical records.
- (ii) In the 2<sup>nd</sup> and 4<sup>th</sup> semesters, external viva voce exam will carry 50 marks(one external examiner and one internal examiner) and 50 marks shall be awarded for clinical work for whole semester.

#### 4.5 Dissertation

In the 4<sup>th</sup> semester, there are only 3 papers, one external viva voce examination and one dissertation prepared under supervision. This has to be assessed by one internal and one external examiner for 100 marks each, the average of which shall be awarded to the candidate

The candidates shall submit four copies of dissertation before the commencement of the theory examination of that semester. Candidates who fail to submit their dissertation on or before the stipulated date shall not be permitted to appear for the final semester examination.

#### 5.0 Scheme of Instruction:

- 5.1 In each semester there shall be five papers. The detailed scheme of examination and paper titles are as given in Annexure 1
- 5.2 Dissertation shall be in lieu of a theory paper
- 5.3 The syllabus of every paper shall be as far as possible, divided into five units
- 5.4 Hours of instruction (contact hours) per week

Theory	:	4 hours per subject per week
Practical	:	15 hours per week

## **6.0 Board of Examiners, Valuation**

6.1 There shall be a Board of Examiners for scrutinizing and approving the question papers and scheme of valuation

6.2 About 50% of the examiners for scrutinizing and approving the question papers and scheme of valuation shall be from outside the institution.

6.3 There shall be double valuation for the theory, dissertation and the average of the marks awarded by the internal and external examiners shall be taken as the final award.

6.4 In case of 20% or more deviation in the marks awarded by the internal and the external valuer, the scripts shall be referred to the third valuer and his evaluation will be final.

6.5. Award of Grace marks

Grace marks to the candidate will be awarded based on Bangalore University rules.

## **7.0 Classification of Successful Candidates**

7.1 Minimum for a pass in each paper shall be 40% (theory and continuous evaluation put together) and 50% in aggregate in each semesters. There shall be no separate minima either for theory or for continuous evaluation.

7.2 (a) Successful candidates in each semester shall be classified as follows

- i. First class : Those who obtain 60% and above of the aggregate marks
- ii. Second class: Those who obtain above 50% and below 60% of the aggregate marks
- ii. However, only the candidates who have passed the examination at the first appearance shall be eligible for the declaration of marks. The first five ranks shall be notified.

(b) Announcement of result, classes and ranks for the course as a whole

- i. Ranks and classes shall be declared for the successful candidates taking their total performance in all the semesters put together
- ii. Distinction: All the successful candidates who secure 75% and above in their total performance shall be declared to have passed the Masters Degree examination with Distinction.
- ii. First Class: All the successful candidates who secure 60% and above in their total performance shall be declared to have passed the Masters Degree examination in first class
- iii. Second Class: All the successful candidates who secure between 50% and 60% in their total performance shall be declared to have passed the Masters Degree examination in second class
- iv. However, only candidates who have passed each of the University examinations at the first appearance shall be eligible for the declaration of class/ranks. The first five ranks shall be notified.

- v. For the declaration of overall class a candidate should complete the course within the minimum stipulated duration of the course.

## **8.0 Provision for Repeaters**

8.1 A candidate is allowed to carry all the previous uncleared papers to the subsequent semester/s

8.2 Such of those candidates who have failed/remained absent/opt to improve in any one or more papers (theory)hence forth called as repeaters shall appear/improving in such paper/s during the two immediate successive examinations.

8.3 Examination for odd/even semester shall be conducted respectively at the end of odd/even semester(odd with odd, even with even).

8.4 The candidate shall take the examination as per the syllabus and the scheme of examination in force during the subsequent appearances.

8.5 A candidate who seeks improvement has to surrender the marks already secured in the particular paper/s and marks card of that semester.

8.6 Improvement is allowed only for passed candidates in theory and not permissible in practical/dissertation work. However the marks secured in the previous attempt shall be retained if the same is higher. There is no provision for improvement of continuous evaluation.

8.7 A candidate is permitted to apply for improvement in any paper of particular semester within 30 days from the date of announcement of results of the semester.

8.8 A repeater(including a candidate who seeks improvement) shall not be eligible for rank.

8.9 A candidate should complete the Master's Degree Examination within 4 academic years from the year of admission.

## **9.0 Miscellaneous**

Any other issue not envisages above shall be resolved by the Vice Chancellor in consultation with the appropriate body of the University which shall be final and binding.

## Course Content

### I Semester

Code no.	Paper Title	Theory Hrs/wk	Total (Theory+ IA)
Aud 101	Research Methods & Statistics in Speech Language Hearing Sciences	04 Hrs	80 + 20
Aud 102	Instrumentation for Speech Language Hearing Sciences	04 Hrs	80 + 20
Aud 103	Auditory Physiology	04 Hrs	80 + 20
Aud 104	Psychoacoustics (Part – I)	04 Hrs	80 + 20
Aud 105	Clinical Practicum (Internal)	15 Hrs	80 + 20

### II Semester

Code no.	Paper Title	Theory Hrs/wk	Total (Theory+ IA)
Aud 201	Neurophysiology of hearing	04 Hrs	80 + 20
Aud 202	Psychoacoustics (Part – II)	04 Hrs	80 + 20
Aud 203	Medical Audiology	04 Hrs	80 + 20
Aud 204	Seminars in Hearing Assessment	04 Hrs	80 + 20
Aud 205	Clinical Practicum (Internal + External)	15 Hrs	50 + 50

### III Semester

Code no.	Paper Title	Theory Hrs/wk	Total (Theory+ IA)
Aud 301	Speech Perception Part - I	04 Hrs	80 + 20
Aud 302	Physiological Assessment of Hearing	04 Hrs	80 + 20
Aud 303	Listening Devices of Hearing Impaired	04 Hrs	80 + 20
Aud 304	Advances in Management of the Hearing Impaired	04 Hrs	80 + 20
Aud 305	Clinical Practicum (Internal)	15 Hrs	80 + 20

### IV Semester

Code no.	Paper Title	Theory Hrs/wk	Total (Theory+ IA)
Aud 401	Auditory Processing Disorders	04 Hrs	80 + 20
Aud 402	Audiology in Practice	04 Hrs	80 + 20
Aud 403	Speech Perception Part-II	04 Hrs	80 + 20
Aud 404	Dissertation (Internal + External)	04 Hrs	80 + 20
Aud 405	Clinical Practicum (Internal + External)	15 Hrs	50 + 50

## I Semester

Code no.	Paper Title	Theory Hrs/wk	Total (Theory+ IA)
Aud 101	Research Methods & Statistics in Speech Language Hearing Sciences	04 Hrs	80 + 20
Aud 102	Instrumentation for Speech Language Hearing Sciences	04 Hrs	80 + 20
Aud 103	Auditory Physiology	04 Hrs	80 + 20
Aud 104	Psychoacoustics (Part – I)	04 Hrs	80 + 20
Aud 105	Clinical Practicum (Internal)	15 Hrs	80 + 20

### Aud 101 Research Methods & Statistics in Language & hearing sciences

#### Unit 1: Types of Research

- Review of basic research methods, strategies and designs in speech-language pathology and Audiology
- Types of research in speech language pathology and Audiology. Ex-post facto research, normative research, standard group comparison, experimental research clinical and applied research, sample surveys, evaluation research
- Methods of observation and measurement in speech language pathology and audiology

#### Unit 2: Experimental Design and Documentation

- The structure and logic of experimental designs, single subject designs and group designs, organization, format and writing style
- Legal, ethical and cultural considerations/evidence based practices for research in speech language pathology and audiology

#### Unit 3: Evaluation of research studies and statistical methods used

- Evolution of research methods in speech and hearing since 1960s
- Review of studies in speech and hearing as established in standard journals
- Critical analysis of methods employed and identification of models of research that may be unique to different areas
- Methods of experimental research in allied areas-(linguistics, neurology, clinical psychology, genetics, physics and acoustics) and their application to speech and hearing
- Epidemiological research in speech and hearing

#### Unit 4: Measures of central tendency. Parametric and non parametric measures

- Review of basic statistics, statistical method and their features.
- Statistical inference: methods of correlation and regression (including multiple & logistic regression and path analysis) cause and effect relation, chi square, population estimate probability, probability laws and hypothesis testing. The concept, theoretical distributions, estimations – point and interval estimation. Application to speech language pathology and Audiology with specific examples.
- Analysis of variance and co-variance (ANOVA & ANCOVA): Basic Models, assumptions, one way and two-way classification, need for non-parametric tests. Consequence of failure of assumptions underlying ANOVA. Testes for additivity, homogeneity, transformation. Post-hoc tests, analysis of co-variance. Repeated measure
- Non-parametric statistics: non normal distributions, central limit theorem

#### Unit 5: Analysis of quantitative and qualitative data

- Analysis of qualitative data: contingency tables, measures of association, Kappa co-efficient, log linear models, content analysis
- Multivariate analysis: need, various methods, principal component analysis, factor cluster, discriminant function, MANOVA, MANCOVA

## References

### Research Methods and Statistics in Speech Language and Hearing Sciences

1. Basic statistics (2001). Olive Jean Dunn, Vigemaclark. Waley-Interscience Publication ISBN 0471-35422-8
2. Carment Lum (2002) Scientific thinking in speech and language therapy(Lawrence Erlbaum Associates, Publishers)
3. David Maxwell & Eiki Satake (97) Research & Statistical Methods in Communication disorders (Williams & Wilkins)
4. Doehring (1998) Research strategies in human communication disorders, Pro-ed Austin
5. Garret E.H (1969), Statistics in Psychology & Education. Wakils Feffer, Mumbai
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9. Kerlinger F.N. (1964) Foundations of behavioural research. Rinehart & Winston, New york
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14. Statistics for people who hate statistics. Neit J.Salkuid (2000) Stage Publications, Inc.

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Allyn & Bacon, Boston

## **Aud 102**

### **Instrumentation For Speech-Language And Hearing Sciences**

#### Unit 1: Fundamentals of electronics and computers

- (a) Basic principle of operation and working of
  - Diodes, Transistors, FET's & UJT's, LED's, LCDs, ICs
  - D.C.Power supplies, a-c voltage stabilizers and UPS
- (b) Fundamentals of Digital Electronics
  - Binary number system, Hex code, ASCH code, bit, byte, etc
  - Logic gates, counters, flip-flops etc
- (c) Fundamentals of computers:
  - Block diagram of a computer and its working
  - Hardware, memory devices and other peripherals
  - Operating system languages, application software
  - Programs, flow charts
  - Internet and networking computers

#### Unit -2 Fundamentals of Digital Signal processing and communication system

- (a) Analog and digital systems
  - Analog signal and digital signals
  - Analog to digital and digital to analog converters
  - Need and advantages of digital systems and digital signal processing
- (b) Principles of digital signal processing
  - IIR system, its realization and implication
  - Basics of IIR and FIR filters and their implication
- (c) Fundamentals of communication systems
  - AM transmission and reception
  - FM transmission and reception
  - Digital modulation techniques such as delta modulation, PCM,PPM, PWM and their application in speech analysis
  - Satellite communication

#### Unit – 3 Biomedical signals and Signal Processing

- (a) Principles of generation of acoustic stimuli
  - Puretone, tone bursts clicks, filtered clicks and warble tones
  - Acoustic/physical characteristics of all stimuli
  - Generation gating and filtering of stimuli
- (b) Evoked potential

- Worked principle
  - Electrodes
  - Recording of responses
- (c) Electrodes and transducers
- Signal acquisition techniques from electrodes and transducers
  - Signal processing techniques such as differential amplification, common mode rejection, artifact rejection, filtering, signal averaging etc
  - Addition and subtraction waves

#### Unit – 4 Technology for hearing science

- (a) Principle and working
- Body level hearing aid
  - BTE hearing aid
  - Digital, DSP based/programmable hearing aids
  - FM hearing aids
- (b) Evaluation of hearing aids
- Electroacoustic characteristics
  - National and International standards
  - Hearing aid evaluation systems
- (c) Techniques of speech processing and analysis
- Voice response system
  - Speaker recognition system and speech recognition system
  - Speech synthesis methods

#### Unit – 5 Technology for speech and language science

- (a) Electro-physiological methods in diagnosis
- Fundamental principles of ELG
  - Fundamental principles of EMG
- (b) Neuro-radiological methods in diagnosis
- Working principles
  - Interpretation and implications
- (c) Tools/studies to understand the organization of speech and language disorders and functions
- Cortical blood flow studies
  - Radio imaging techniques, functional MRI
  - Application of tools in studying genetic bases of speech language disorders.

## References

### **Aud 102 INSTRUMENTATION FOR SPEECH – LANGUAGE AND HEARING SCIENCES**

- Ainsworth, W.A. (1988) Speech recognition by machine, London Peter Pen prints
- Ainsworth W. A. (ed) (1990) Advances in Speech, Hearing and Language Processing Research Annuals: Vol. 1, London, Jaipress
- Baber. C & Noyes. J. M. (1993). Interactive Speech Technology Human latest technique with Application of Speech input output to computers. London Taylor and Francis
- Bapat (1993) Ellectronic circuits and syntax, New Delhi. Mc. Graw Hill
- Beraneck (1954) Acoustical Engg, New York. Mc. GRaw Hill
- Danloff. R. G. (1985) Speech Sciences: Recent advances London Taylor and Francis
- Gottingen. M> R. S> (Ed)(1985) Speech and Speaker Recognition, Basel Kager
- Greme (1973) Application of Opamps New York Mc. Graw Hill
- Grob (1982) Electronic circuits and applications. London. Mc. Graw Hill
- Hall. Microprocessor and interfacing programming hardware. New Delhi Mc. Graw Hill
- Hall. J. W. (1992) Handbook of Auditory evoked responses. Masschuseettes Allyn & Bausen
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- Jacobson, J. T (Ed) (1994) Auditory brainstem response. Taylor & Francis. London
- Johnson (1992) Introduction to digital signal processing. New Delhi. Mc Graw Hill
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- Potter. R. R. Kopp G. A. & Green. H. G. (1966) Visible Speech. New York. Dover Publications.
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- Rabinette, M. S. & Slanke. L. L. (Eds) (1997) Otoacoustic emissions. Clinical applications Thicme, New York.
- Ryder (1978) Electronic fundamentals and applications. Integrated and discrete systems. New Delhi. Prentice Hall of India.
- Sanders D. A. (1993) Management of the hearing handicapped from infants to elderly. Prentice Hall inc. NJ
- Sawashuma M & Cooper E. S> (1977) Dynamic aspects of speech production., Japan University of Tokyo Press.
- Shansessy W. D. Computers in communication disorders.
- Shuzo S (1993) Speech and Phonology JOS Press

## **Aud 103 Auditory Physiology**

- Unit 1 (8 hours)
- External ear: Anatomy & Physiology of lower animals and humans. Role of Pinna & external auditory meatus in hearing. Resonance properties of external ear & auditory canal
  - Non auditory physiology of external ear
  - Developmental changes
  - Application to clinical audiology
  - Temporal bone anatomy - role in hearing
  - External ear models
- Unit 2 – Middle ear: Anatomy & Physiology of lower animals and humans.(11 hrs)
- Middle ear transformer action
  - Responses to different frequencies
  - Non linearity of the middle ear
  - Protective function of the middle ear
  - Concept of acoustic impedance
  - Acoustic and non acoustic reflex pathways
  - Anatomy and physiology of the Eustachian tube
  - Middle ear models
- Unit 3 – Cochlea: Anatomy in lower animals and humans (8 hrs)
- Macro & Microanatomy
  - Blood supply
  - Innervation
  - Cochlear fluids – origin, absorption, composition, dynamics and functions
  - Cochlear models
- Unit 4 – Physiology of the Cochlear (15 hrs)
- Modes of bone conduction
  - Cochlear mechanics – basilar membrane mechanics - historical and current status
  - Cochlear transduction
  - Cochlear electrophysiology
  - Cochlear potentials their generation and properties
  - Cochlear non-linearity-two tone suppression, otoacoustic emission & other recent advances
  - Proteins in the cochlea
  - Pathophysiology & perception
  - Repair, regeneration, protection in the cochlea
  - Theories of hearing
    - Historical aspects
    - Place theory – resonance & nonresonance

- Frequency theory
- Traveling wave theory
- Other recent advance like motor theory etc

Unit 5: Vestibular System

(10 hrs)

- Anatomy and physiology of vestibular structures and vestibular nerve
- Integration of senses in balance
- Vestibulo ocular reflex
- Vestibulo spinal reflex

## References

### Auditory Physiology

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23. Williams.P.J.(Ed)2004: Genetic hearing loss Mareal Dekkes, USA

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25. Yost.W.A. Neilson.D.W (1977): Fundamentals of hearing –an introduction. Holr. Rineheart & Winston, USA.

## **Aud 104 Psychoacoustics Part I**

- Unit 1 (10 hrs)
- Theory of signal detection,
  - Concept and application, ROC etc
  - Methods in psychoacoustics classical & adaptive
  - MAP & MAF underwater hearing, relation to calibration
  - Relevance in clinical audiology
- Unit 2 (12 hrs)
- Critical band concept,
  - equivalent rectangular band concept,
  - frequency resolution, excitation pattern,
  - Masking, PTC, using simultaneous and non simultaneous maskers, central masking, pulsation threshold, profile analysis,
  - Two tone suppression, critical band widening in cochlear loss,
  - Clinical application and MDI
- Unit 3 (12 hrs)
- Loudness perception, equal loudness level contours loudness and loudness level, scaling
  - Factors affecting models of loudness,
  - Weber's Law near and far miss
  - Differential sensitivity for intensity, absolute and relative DL,
  - Loudness perception in pathological ears, recruitment, dynamic range, loudness adaptation
  - Florentine theory of softness imperception,
  - Clinical application.
- Unit 4 (10 hrs)
- Temporal perception,
  - Temporal acuity, temporal DL, temporal order,
  - Gap detection (in broad band noise, in narrow band noise, sinusoid) temporal integration
  - Duration discrimination
  - Temporal aspects of speech
  - Temporal modulation transfer function
  - Factors affecting temporal perception
  - Pathological ears and temporal perception
  - Clinical application.
- Unit 5 (8 hrs)
- Adaptation and fatigue,
  - levels of adaptation & physiology
  - Methods to study
  - Parameters affecting
  - Clinical applications
  - Pathophysiology of fatigue

### Psychoacoustics

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- Syka Joel. “Acoustical Signal Processing in the Central Auditory System” Plenum Press 1997.
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- Warren R.M 1999. Auditory Perception-A new Analysis and synthesis UK: Cambridge University Press, U.K.

## II Semester

Code no.	Paper Title	Theory Hrs/wk	Total (Theory+ IA)
Aud 201	Neurophysiology of hearing	04 Hrs	80 + 20
Aud 202	Psychoacoustics (Part – II)	04 Hrs	80 + 20
Aud 203	Medical Audiology	04 Hrs	80 + 20
Aud 204	Seminars in Hearing Assessment	04 Hrs	80 + 20
Aud 205	Clinical Practicum (Internal + External)	15 Hrs	50 + 50

### Aud 201 Neurophysiology of Hearing

#### Unit 1 – Auditory nerve (11 hrs)

- Structure and tonotopic organization
- Development of auditory nerve in mammals
- Structure and contents of IAM
- Refractory period, adaptation, firing rates, types of responses
- Electrophysiology – action potential, generation and properties
- Stimulus coding, frequency, intensity, time, complex signals, speech
- Non linearity

#### Unit 2 - Brain stem (11 hrs)

- Anatomy of CN, types of cells distribution
- Anatomy of SOC, LL, IC, MGB
- Non classical pathway
- Tonotopic organization
- Development of the central auditory pathway
- Neurophysiology at different levels
- Localization
- Stimulus coding
- Development of central auditory processing

#### Unit 3 – Auditory cortex (12 hrs)

- Anatomy and tonotopic organization of primary and secondary auditory areas
- Neurobiological relationship between auditory cortex and other areas
- Neurophysiology of auditory areas
- Stimulus coding – frequency, intensity and time
- Role of auditory cortex in localization

#### Unit 4 – Efferent Pathway (10 hrs)

- Neuro anatomy and neuro physiology
- Olivo cochlear feed back gain control system
- Medial and lateral efferent effect on cochlear physiology ,Auditory Nerve and CN
- Perception of auditory stimulus

- Protective function
- Anatomy of cranial nerves related to hearing
- Effect of associated cranial nerves on ear physiology

Unit 5 – Neurotransmitters in the auditory system (8 hrs)

- Types of synapses
- Neurotransmitters and neuromodulators.
- Properties and functions
- Afferent and efferent neurotransmitters
- Receptors

**Neurophysiology of Hearing**

- Berlin C.I; Weyand T.G (Eds) 2003 – The Brain & sensory plasticity: Language acquisition and hearing. Thomson/Delmer Learning
- Bellies T.J 2003 – Assessment & Management of central auditory processing disorders in the educational setting from science to practice. Singular Publishing Group. USA
- Ehret G. Romand R (Eds) 1997: The central Auditory system. Oxford University Press, New York
- McPherson D.L 1996 – Late potentials of the auditory system. Singular Publishing Group. Inc
- Palmer A.R; Rees A; Summerfield A Q; Meddis R (Eds) 1998, Psychophysical & Physiological advances in hearing. Whurr Publishers Ltd, London
- Parks T.N; Rubel E.W; Fay R.R; Popper A.N (Eds) 2004. Plasticity of the auditory system. Springer, New York
- Popper A.N; Fay R.R (Eds) 1992: The mammalian auditory pathway: Neurophysiology. Springer – Verlay, N.Y.
- Rerben E.W; Popper A.N; Fay R.R (Eds) 1998. Development of the Auditory System. Springer – Verlay, N.Y.
- Sahley T.L ; Nodar R.H; Musiek F.E 1997, Efferent auditory system structure and function - Singular Publishing Group. USA
- Syker. J(Ed) 1997 – Acoustical signal processing in the central auditory system Plenum Press
- Wada. H; Tukasade T; Ikeda. K; Ohyama K; Koiki T (Eds) 2000. Recent developments in auditory machines World Scientific Publishing Co.
- Webster D.B; Popper A.N; Fay R.R (Eds) 1992. The Mammalian Auditory Pathway – Neuroanatomy Springer – Verlag, N.Y

## Aud 202. Psychoacoustics Part II

- Unit-1 (12 hrs)
- Pitch perception, factors affecting
  - Ohm's law, Neurophysiological basis
  - Theories and models, consonance
  - Dissonance, pitch of complex tones
  - Differential sensitivity for frequency, Absolute and relative DLF's, methods to study
  - Clinical applications.
  - Affects of pathology
- Unit 2 (10 hrs)
- Timbre perception - Factors affecting
  - Object perception – Object identification, information used to separate auditory objects, fundamental frequency, contrast with previous sounds, sound location
  - Affects of pathology
  - Clinical application
- Unit 3 (10 hrs)
- Auditory scene analysis,
  - Top-down versus bottom-up information processing
  - Segmentation and feature estimation
  - Oscillatory correlation and Neural Architecture
- Unit 4 (10 hrs)
- Space perception
  - Localization
  - Minimal audible angle
  - Role of pinnah in perception
  - Cone of confusion
  - Monoaural localization
  - Effects of pathology
- Unit 5 (10 hrs)
- Binaural hearing
  - MLD
  - Lateralization, binaural integration, binaural advantage
  - Binaural DLF,DLI, DLT, squelch, beats, rotating tones
  - Time intensity trade
  - Durlach and Jeffress models
  - Clinical application

## **Psychoacoustics II**

### **References**

- Rosenthal DF & Okiano H G “Computational Auditory Scene Analysis”  
Lawrence Erlbaun Associates, Publishers 1998.
- Hawkins H L, Mc Muller TA, Popper A N, Fay R R “Auditory Computation”  
Springer Verlag 1996.
- Yost “Directional Hearing” – Wiley 2000
- Hirsh S K, Eldredge DH, Hirsh F J & Silverman R. “Hearing & Davis”.  
Washington University Press 1976.

## Aud 203. MEDICAL AUDIOLOGY

- UNIT- 1 (8 hrs)
- Conditions related to external and middle ear pathophysiology
  - Audiological findings and management
  - Consequences of conductive pathology
- UNIT- 2 (12 hrs)
- Conditions related to cochlea and vestibule – pathophysiology, Audiological findings & management in
    - Sudden hearing loss
    - Systemic disorders
    - Meneier's Disease
    - NIHL
    - Acoustic Trauma
    - Ototoxicity
    - Other cochlear pathologies
  - Dead regions of Cochlea
  - Tinnitus evaluation & management
  - Hyperacusis evaluation management
- UNIT- 3 (12 hrs)
- Conditions related to auditory nerve and central auditory pathway
  - pathophysiology , audiological findings and management
  - Tumors of auditory nerve, Multiple Sclerosis, Auditory dysynchrony
- UNIT- 4 (10 hrs)
- Non audiological tests :
    - X rays, PET, MRI,CT, Others
    - Lab tests
    - ENG
- UNIT- 5 (10 hrs)
- Genetics related to hearing loss
  - Gene therapy
  - Syndromic Vs Non-Syndromic hearing loss
  - Audiological findings
  - Overview of methods used for identifying genes
  - Audiological findings in carriers of genetic hearing loss

## Medical Audiology

### References

1. Axelsson.A., Borchgrevink.H., Hamernik.R.P., Hellstrom.P., Henderson.D., Salvi.R.J.(1996): Scientific bans of noise induced hearing loss. Thieme, N.Y., U.S.A.
2. Beagley.H.A(Ed) 1981- Audiology & Audiological medicine.Vol I & II., Oxford University press, USA
3. Berlin.C.I (Ed) 1997: Neurotransmission & hearing loss basic science, diagnosis & management. Singular publishing group, USA
4. Bellis T.J (2<sup>nd</sup> Ed) 2003: Assessment & management of central auditory processing disorders in the educational setting-from Science to practice. Delmas learning, USA.
5. Browsing.G.G (1998): Clinical otology & audiology. 2<sup>nd</sup> Edition. Butterworth Heinemann, UK
6. Hall.III., J.W., Mueller III H.G (1997)-Audiologists Desk reference. Vol.I- diagnostic audiology-Principles, procedures & practices- Singular publishing group Inc, USA
7. Jerger S., Jerger.J (1981): Auditory disorders a manual for clinical evaluation, Allyn & Bacon, USA
8. Katz's(Ed):1972, 1978, 1985, 1994, And 2002: Handbook of clinical audiology. Lippincott, Williams & Wilkins.
9. Moore.B.C.J., Ashore.J., Haggard.M(Ed) 2002: New development in hearing & balance Oxford University Press, USA.
10. Mencher.G.T., Gerber.S.E.Mc.Combe.A (1997: Audiology & auditory dysfunction. Allyn & Bacon, USA
11. Museik.F.F., Baran.J.A., Pinheiro.M.L(1994): Neuroaudiology: Case studies. Sandiegop Singular publishing group, USA
12. Northern.J.L (Ed) 1984: Hearing disorders little Brown & company, USA
13. Prasher.D, Lerxon.L., Pyykko.I.(Ed)1998: Advance in noise research . Vol I. Biological effects of noise. Whurr Publishers, UK
14. Prasher. D., Luxon.L., Pyykko.II (Ed) 1998: Advance in Noise research Vol II- Protection against noise. Whurr publishers, UK
15. Roeser.R.J., Valente., M., Hosford-Dunn.H (2000): Audiology diagnosis. Thieme., NY, USA.
16. Van De Water.T.R., Popper.A.N., Fay.R.R(Ed) 1996: Clinical aspects of hearing. Springerverlag., USA
17. Vernon.J.A., Moller.A.R(ed) 1995: Mechanism of Tinnitus. Allyn & Bacon, USA
18. Williams.P.J(Ed)2004: Genetic hearing loss Marel Dekker, USA

## **Aud 204. Seminars in Hearing assessment**

- Unit - 1 : Paediatric assessment (10 hrs)
- BOA – formal & informal – Paediatric Audiometer, Reactometer
  - Distraction test
  - VRA, VROCA, modifications
  - Co-operative test
  - TROCA, CORA
- Unit- 2 : Assessment in difficult to test population (10 hrs)
- Issues pertaining to testing
  - Factors affecting choice of test
  - Different population – geriatrics, LD, PDD, MR, CP, blind, cleft palate, schizophrenia and functional hearing loss
- Unit- 3 : Assessment using puretone special tests (10 hrs)
- Brief tone Audiometry, Bekesy Audiometry, Extended High Frequency audiometry, micro audiogram, DLI, DLF, tone decay tests
- Unit- 4 : Speech special test (10 hrs)
- PIPB, SPIN, CAP tests, tests for Pseudohypacusis
- Unit- 5: Assessment of residual auditory skills, self assessment scales. (12 hrs)
- MAC, Helen tests, EST, ESPT(different languages) vowel perception
  - HAPI, COSI, APHAB, IOIHA, etc, Indian questionnaires
  - Children's tests(western & Indian tests)
  - Speech reading tests
  - Audio Visual skill assessment

## Seminars in Hearing Assessment

### References

- Hall II J.W; Mueller III H.G. 1997 – Audiologist Desk Reference Volume I and Volume III Singular publishing group Inc. USA
- Hayes D, Northern J.L 1996 – Infants and hearing Singular Publishing Group. USA
- Hull R.H 1995 Hearing in Aging Sant Diego Singular Publishing Group. USA
- Jerger. J Paediatric Audiology
- Katz. J (Ed) Volume 1 – 5. Handwork of clinical Audiology, Lippincott Williams & Wilkins, U.S.A
- Rintelman W.F (Ed) 1991. Hearing Assesment, 2<sup>nd</sup> Edition, Allyn & Bacon USA
- Rocser R.J; Valente M, Hosford-Duma. H 2000-Audiology Diagnosis .Thieme New York
- Rupp.R.R; Stockdell K.G (Eds)1980 – Speech Protocols in Audiology. Grune & Stratton. N.Y
- Silman. S. Silverman C.A 1991 – Auditory diagnosis principles & applications, Academic press U.S.A
- Van De Water T.R Popper A N and Fay R R Ed(1996) Clinical Aspects of Hearing New York

### III Semester

Code no.	Paper Title	Theory Hrs/wk	Total (Theory+ IA)
Aud 301	Speech Perception Part - I	04 Hrs	80 + 20
Aud 302	Physiological Assessment of Hearing	04 Hrs	80 + 20
Aud 303	Listening Devices of Hearing Impaired	04 Hrs	80 + 20
Aud 304	Advances in Management of the Hearing Impaired	04 Hrs	80 + 20
Aud 305	Clinical Practicum (Internal)	15 Hrs	80 + 20

#### Aud 301. Speech Perception I

##### Unit- 1

(10 hrs)

- Acoustic properties of speech sounds, normalization and categorical perception
- Theories of speech perception – motor, neurological, auditory, acoustic and analysis by synthesis
- Methods to study speech perception – analysis by synthesis, parametric synthesis, articulatory synthesis
- Methods of producing synthetic speech

##### Unit- 2

(10 hrs)

- Vowel diphthong perception, cues, formants
- Factors affecting vowel perception
- Static and dynamic cues
- Affect of co articulation, perception in auditory disorders

##### Unit- 3

(12 hrs)

- Consonant perception, cues for different consonants
- Static and dynamic cues
- Acoustic parameters used to differentiate vowels from consonants
- Factors affecting effect of coarticulation
- Perception in auditory disorders.

##### Unit- 4

(10 hrs)

- Short term memory and speech perception
- Stages of memory, coding at different stages, theories of memory
- Perception of consonants and vowels in short term memory
- Animal perception - consonant and vowel perception, categorical perception, animal versus human perception.

## Unit- 5

(10 hrs)

- Infant perception- methods to study
- Theories of infant perception
- Perception of consonants and vowels in infants
- Comparison of adult and infant perception,
- Universality in perception,
- Word perception,
- Lexical neighborhood

### Speech Perception I

#### References

- Ainsworth W.A(1976) Mechanism of Speech Recognition, International series in natural philosophy. Vol. 85, Oxford: Pergamon Press
- Ainsworth W.A(1990) Advances in Speech, hearing and language processing Vol. 1, London Jai Press Ltd.
- Berlin C(1984) (Ed.) Hearing Science. San Diego: College-Hill Press
- Borden G.J and Harris K.S(1980). Speech Science primer: Physiology, acoustics and perception of speech, London: Williams and Wilkins
- Cohen,A & Nooteboom, S.G (Eds) (1975) Structure and process in speech perception. New York: Springer-Verlag
- Clark G.M, Cowan R.S C and Richard C D(1997) : Cochlear Implantation for infants and Children –Advances ,Singular publishing Group, London.
- Fant , G; Speech acoustics Phonetics – Klumer Academic Publication 2004
- Gold & Morgan N “Speech & Audiological Processing. “Wiley & Son Inc. 2000
- Goodman J.C and Nusbaum(1994) (Eds) The development of speech perception: The transition from speech sounds to spoken words, MIT Press London
- Hardcastle & Laver J. “The Handbook of Phonetic Sciences” Blackwell Publishers Ltd. 1997 (Delgutte)
- Hish. S.K; Eldredge. D.H. Hish .J; Silveman S.R. 1976
- “Hearing & Davis” Washington University Press”
- Keller E. (1994) Fundamentals of Speech synthesis and speech recognition Basic concepts, state of the art and future challenges John Wiley and Sons New York
- Kent R.D & Read C 1995. The acoustic analysis of speech, A.I.T.B.S Publishers & Distributors, New Delhi. “The Speech Science”
- Lass N.J (Ed) 1976. Contemporary issues in experimental phonetics. Academic Press N.Y
- Nakagawa S Shikanok K, Tohkura. Y (1995) Speech hearing and neural network models. Ohmshia IOS Press Amsterdam
- Pisoni D 2005 “Handbook of Speech Perception” Blackwell Publishing Ltd U.S.A
- Pickett JM, Ravolie SG (1979) Feature Discrimination by persons with sensorineural impairment, in B Lindblom and S. Ohman EDs “Frontiers of Speech Communication Research, AP Londons.

- Sanders. D.A 1977. Auditory Perception of Speech – An introduction to principle & problems,
- Schrveda MR “Speech & Speaker Recognition” Karger 1985
- Schouten MEH 1992. The Auditory processing of speech from sounds to sounds. Morten de Gruter. Berlin
- Tatham M & Mortin K “ Development in Speech Synthesis” Wiley – 1998
- The XIIIth International congress of phonetic sciences – Stockholm 13 – 19 August 1995, Volumes 1 – 4.

### **Aud 302 : PHYSIOLOGICAL ASSESSMENT OF HEARING**

#### **Unit- 1 : Immittance (11 hrs)**

- Principle and instrumentation
- Tympanometry – low and high frequency tympanometry
- Single and multi component
- Multiple frequency tympanometry
- Variables effecting tympanometry
- Reflexometry – AR, NAR, adaptation of AR, ARLT, reflex averaging, reflex sensitization, temporal summation of acoustic reflex, binaural summation of AR
- Factors affecting measurement
- Application of Immittance
- Acoustic reflectance- principles and application

#### **Unit- 2 : OAE (11 hrs)**

- Origin
- Classification
- Principles in recording of OAEs, protocols for infants, protocols for cochlear pathology
- Contralateral suppression
- Interpretation
- Factors affecting
- Clinical application

#### **UNIT- 3 : Early AEP – ECOCHG, ABR, SN 10, FFR,ASSR (10 hrs)**

- Generators
- Principles of recording
- Factors affecting recording / interpretation
- Correlation with FMRI, PET
- Electrical ABR
- Clinical disorders

## UNIT- 4 : MLRs and LLRs

(10 hrs)

- Generators
- Principles of recording
- Factors affecting recording/interpretation including PAM and applications
- Correlation with FMRI, PET
- Electrical LLR
- Clinical disorders

## UNIT- 5 : Endogenous potentials - MMN, P 300,N400 , T Complex L dn, SVP, CNV, N 600

(10 hrs)

- Generators
- Principles of recording
- Factors affecting recording/interpretation
- Electrical recording
- Use of speech and non speech stimuli
- Clinical disorders

## References

### Physiological Assessment of Hearing

- Berlin C. I (Ed) 1996 – Hair cells & hearing aids. Singular Publishing group, London
- Hood.L.J (1998) Clinical applications of the auditory brainstem response Singular Publishing group Inc. U.S.A
- Hall J. W III (1992) Handbook of Auditory evoked responses. Allyn & Bacon U.S.A
- Jacobson J.T (Ed) 1994. Principles & Applications in Auditory evoked potentials Allyn & Bacon U.S.A
- Katz J (Ed) Volume I – V Handbook of clinical audiology, Lippincott, Williams, Wielkins U.S.A
- Ms Phenson L.D 1995 – Late potentials of the auditory system Singular publishing group
- Rintelman W.F 1991 – Hearing Assesment, Allyn & Bacon U.S.A
- Robinette M.S, Glatlke T.J (Eds) 1997. Otoacoustic emissions; Clinical Applications. Thieme N.Y
- Sahley T.L Nodar R.H; Musiek F.F 1997: Efferent Auditory system: Structure& function. Singular Publishing group Inc.
- Wiley T.L Fowler C.G 1997; Acoustic Immittance measures in clinical audiology: A primer Singular Publishing group Inc

**Aud 303. Listening devices for the Hearing impaired**

- Unit- 1 (12 hrs)
- Hearing aids, components
  - Classification
  - Principles of analog, programmable, digital hearing aids, signal enhancing technology
  - EAC
  - outcome measures
  - Ear moulds – types and modifications
- Unit- 2 (10 hrs)
- ALD - types, advances in technology, EAC measurements and accessories
  - Tinnitus maskers
- Unit- 3 (10 hrs)
- Selection procedures for hearing aids, Implants, tactile devices, tinnitus maskers - real ear, behavioral, coupler methods
- Unit- 4 (12 hrs)
- Cochlear implant
    - Description, types, designs and features
    - Surgical procedure and biological safety in brief
    - Speech processing strategies
    - Assessment strategies
    - Post operative measurement – NRT, ESRT, EABR
    - Mapping
    - Psychophysics and outcome
- Unit- 5 (8 hrs)
- Middle ear implant, BAHA, Brainstem implant
    - Description
    - Selection
    - Assessment
    - Management
    - Outcome.

## References

### Listening Devices for Hearing Impaired

- Clark G.M; Cowan B.S; Dowel R.C1997. Cochlear Implantation for infants and children: Advances Singular Publishing group Inc
- Mueller H.G; Hawkins D; Northern C.J 1992. Probe microphone measurements; Hearing aid selection and assessment Singular Publishing group Inc
- Hersh M.A; Johnson M.A. 2003 – Assistive technology for the hearing impaired, Deaf and deaf blind, Springer, London
- Sandlin E.R (Ed) 1995, Handbook of hearing aid amplifications. Volume 1. Theoretical & technical considerations Singular Publishing group Inc, London
- Sandlin E.R (Ed) 1995, Handbook of hearing aid amplifications. Volume II. Clinical considerations and fitting practices. Singular Publishing group Inc, London
- Studenbaker G.A; Hochberg I 1993. Acoustical factors affecting hearing aid performance. 2<sup>nd</sup> edition Allyn & Bacon U.S.A
- Velente M 1994 Strategies for selecting and verifying hearing aid fittings Thieme N. Y
- Velente M 1996 Hearing aids standards, options and limitations, Thieme N.Y

**Aud 304. Advances in management of the Hearing Impaired**

- Unit- 1 (12 hrs)
- Consequences of hearing loss (speech & language, Impact on family, associated problems, education, vocational)
  - Approaches to management
  - Sensory Integration Therapy
  - Inputs of occupational therapy
- Unit- 2 (12 hrs)
- Management of infants & preschool children
  - Multiple handicapped
  - AVT and CI therapy
  - Outcome measures
  - Team approach
- Unit – 3 (10 hrs)
- Management of school children
  - Outcome measures
  - Team approach
  - Auditory training
  - Language teaching – natural vs structural method
  - Educational options - how to select/how to measure success
- Unit – 4 (10 hrs)
- Management of adults & geriatrics
  - Group training
  - Speech reading
  - Communicative strategies
  - Counseling
  - Team approach
- Unit – 5 (8 hrs)
- Tinnitus management
  - Vestibular management
  - Team approach

## References

### **Advances in Management of hearing impaired**

- Alpiner J.G (Ed) 1982 – Handbook of Adult Rehabilitative Audiology – 2<sup>nd</sup> Edition. William & Welkins U.S.A
- Alpiner J.G; McCarthy P.A(Ed) 1993 – Rehabilitative Audiology Children & Adults William & Welkins U.S.A, William & Welkins 2000, 3<sup>rd</sup> Edition
- Hull R.H (Ed) 2001 – Aural Rehabilitation – serving children and adults, 4<sup>th</sup> edition, Singular Publishing Group Inc
- Luxon L.M (Ed) 2001 – Davies R.A (Eds) 1997 – Handbook of vestibular rehabilitation, Whurr Publisher Ltd, London
- Sanders D.A 1971 – Aural Rehabilitation Prentice Hall, Inc, U.S.A
- Tye Murray. N 1998 – Foundations of Aural Rehabilitation Singular Publishing Group , Inc, U.S.A
- Tye Murray. N 2005 – Foundations of Aural Rehabilitation in Children and Adults & their family members (2<sup>nd</sup> edition) Thomson Delmar Learning Newyork
- Vernon J.A; Moller A.R (Ed) 1995: Mechanisms of tinnitus, Allyn & Bacon, U.S.A

#### IV Semester

Code no.	Paper Title	Theory Hrs/wk	Total (Theory+ IA)
Aud 401	Auditory Processing Disorders	04 Hrs	80 + 20
Aud 402	Audiology in Practice	04 Hrs	80 + 20
Aud 403	Speech Perception Part-II	04 Hrs	80 + 20
Aud 404	Dissertation (Internal + External)	04 Hrs	80 + 20
Aud 405	Clinical Practicum (Internal + External)	15 Hrs	50 + 50

#### Aud 401 AUDITORY PROCESSING DISORDERS

Unit – 1 ( 12 hours)

- Theoretical basis for APD problems; Overview of Anatomy & Physiology
- Classification of APD's – Conditions in which APD exist
- Neural maturation and auditory processing
- Neural degeneration and auditory processing
- Signs and symptoms of APD

Unit – 2 (10 hours)

- Behavioral tests in the assessment of APD – Paediatric, Adults
  - Screening
  - Questionnaires
  - Subtests of speech language tests
  - Audiological tests – process bases tests
- Factors affecting assessment

Unit – 3 (10 hours)

- Objective test in the assessment of APD – Paediatric, Adults
  - ABR
  - AMLR
  - ALLR
  - MMN
  - P300
  - Contralateral suppression of OAE's
  - Factors affecting

Unit – 4 (8 hours)

- Correlation of audiological with non-audiological findings in APD
- Influence of Linguistic variations in assessment and management

## Unit – 5

(12 hours)

- Management of APD
- Choice of management based on audiological test results
- Environmental modification
- Devices
- Auditory perceptual training
- Communication strategies
- Cognitive/language management
- Recording improvement in therapy
- Factors affecting management
- Team approach

**Auditory Processing Disorders**

**References**

- Bellis T. J (1996). Assessment and management of central auditory processing disorders in the educational setting – from science to practice. Singular Publishing Group. Inc
- Chermak G.D and Musiek F E (1997) Central Auditory processing disorders – New Perspectives San Diego Singular Publishing Group. Inc
- Katz. J (1994) Handbook of Clinical Audiology (4<sup>th</sup> edition) Williams & Wilkins Co.U.S.A
- Katz. J (2002) Handbook of Clinical Audiology (5<sup>th</sup> edition) Lippincott Williams & Wilkins Co. U.S.A
- Musiek J.F; Baron J.A; Pinhiero M.L (1994) Neuro Audiology; Case studies, Theirs
- Roeser R.R, Valente M & Hosford – Dunn D (Eds) 2000, Audiology Diagnosis, Thieme N.Y
- Willeford, J.A; Burleigh J.M (1985) Handbook of CAPD in children. Grune & Stratton, Inc.

## **Aud 402 Audiology in Practice**

- Unit 1 (10 hrs)
- Audiological practice in rural/tribal areas(setting up the centre, equipment for the centre, test protocols, rehabilitation, follow up)
  - Audiological practice in a school setup(setting up the centre, equipment for the centre, test protocols, rehabilitation, follow up)
- Unit 2 (10 hrs)
- Audiological practice in Paediatric setup(setting up the centre, equipment for the centre, test protocols, rehabilitation, follow up)
  - Audiological practice in an otorhinolaryngological setup(setting up the centre, equipment for the centre, test protocols, rehabilitation, follow up)
  - Audiological practice in an neurological setup(setting up the centre, equipment for the centre, test protocols, rehabilitation, follow up)
- Unit- 3 (8 hrs)
- Audiological practice in an industrial setup(setting up the centre, equipment for the centre, test protocols, rehabilitation, follow up)
  - Audiologist as a private practitioner
- Unit- 4 (12 hrs)
- Medico-legal aspects in Audiology
  - Forensic Audiology
  - Audiologist as a witness
  - Ethics in practice(in India and other countries)
  - Legislation – International and national
  - Audiology- telpractice, concept need and requirements
- Unit – 5 (12 hrs)
- Welfare measure for the hearing impaired
  - National/International standards related to Audiology
    - Test environment
    - Equipment
    - Ear protection Devices
    - Hearing aids
    - Calibration of instruments

## Audiology in Practise

### **References**

- Dunn H.H; Dunn D.R Harford E.R 1995. Audiology & Business & Practise Management Singular Publishing Group. Inc
- Dunn H.H; Roeser R.J; Valente M (2000).Audilogy-Practise Mangement, Thieme N.Y
- Rizzo S.R, Trudeau M.D (1994) – Clinical Administration in Audiology & Speech Language Pathology Singular Publishing Group. Inc

## Aud 403. Speech Perception II

- Unit – 1 (12 hrs)
- Speech intelligibility and perception of supra segmentals
  - Methods- Subjective (perceptual tests) , Objective (Articulation Index, Speech intelligibility index. Speech transmission index)
  - Comparison of two methods
  - Factors influencing – stimulus based, subject based, transmission based factors
  - Clinical application – in evaluation , rehabilitation and research
- Unit – 2 (8 hrs)
- Visual and tactile perception
  - Perception of segmental and supra segmental cues
- Unit – 3 (12 hrs)
- Perception through different devices
    - Hearing aids
    - Cochlear implants – Single channel, multi channel, vowels, consonants, SRS scores, supra segmental scores, affect of coding strategy, effect of implant model
    - Middle ear implant
    - BAHA
  - Comparison of perception through different devices
- Unit – 4 (12 hrs)
- Speech perception in noise ( types of noise, different signal to noise ration, different degrees of hearing impairment )
  - Children, adults, geriatric population, hearing impaired, LD etc
  - Effect of reverberation on speech perception (different - ages, reverberation times, degrees of hearing impairment)
  - Combined effect of noise and reverberation
  - Effect of non-native accent on speech perception
- Unit – 5 (8 hrs)
- Dichotic listening – theories,
  - Factor affecting
  - Clinical application

## Speech Perception II

### References

- Ainsworth W.A(1976) Mechanism of Speech Recognition, International series in natural philosophy. Vol. 85, Oxford: Pergamon Press
- Ainsworth W.A(1990) Advances in Speech, hearing and language processing Vol. 1, London Jai Press Ltd.
- Berlin C(1984) (Ed.) Hearing Science. San Diego: College-Hill Press
- Borden G.J and Harris K.S(1980). Speech Science primer: Physiology, acoustics and perception of speech, London: Williams and Wilkins
- Cohen,A & Nooteboom, S.G (Eds) (1975) Structure and process in speech perception. New York: Springer-Verlag
- Clark G.M, Cowan R.S C and Richard C D(1997) : Cochlear Implantation for infants and Children –Advances ,Singular publishing Group, London.
- Fant , G; Speech acoustics Phonetics – Klumer Academic Publication 2004
- Gold & Morgan N “Speech & Audiological Processing. “Wiley & Son Inc. 2000
- Goodman J.C and Nusbaum(1994) (Eds) The development of speech perception: The transition from speech sounds to spoken words, MIT Press London
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- Hish. S.K; Eldredge. D.H. Hish .J; Silveman S.R. 1976
- “Hearing & Davis” Washington University Press”
- Keller E. (1994) Fundamentals of Speech synthesis and speech recognition Basic concepts, state of the art and future challenges John Wiley and Sons New York
- Kent R.D & Read C 1995. The acoustic analysis of speech, A.I.T.B.S Publishers & Distributors, New Delhi. “The Speech Science”
- Lass N.J (Ed) 1976. Contemporary issues in experimental phonetics. Academic Press N.Y
- Nakagawa S Shikanok K, Tohkura. Y (1995) Speech hearing and neural network models. Ohmshia IOS Press Amsterdam
- Pisoni D 2005 “Handbook of Speech Perception” Blackwell Publishing Ltd U.S.A
- Pickett JM, Ravolie SG (1979) Feature Discrimination by persons with sensorineural impairment, in B Lindblom and S. Ohman EDs “Frontiers of Speech Communication Research, AP Londons.
- Sanders. D.A 1977. Auditory Perception of Speech – An introduction to principle & problems,
- Schrvada MR “Speech & Speaker Recognition” Karger 1985
- Schouten MEH 1992. The Auditory processing of speech from sounds to sounds. Morten de Grugter. Berlin
- Tatham M & Mortin K “ Development in Speech Synthesis” Wiley – 1998
- The XIIIth International congress of phonetic sciences – Stockholm 13 – 19 August 1995, Volumes 1 – 4.

### **List of Journals for reference in subjects related to Audiology**

1. Asia Pacific Journal of Speech, Language and Hearing
2. Audiology and Neuro-otology
3. Ear and Hearing
4. Hearing Journal
5. Journal of Acoustical Society of America
6. Journal of Speech, Language and Hearing Research
7. Language, Speech and Hearing services in school
8. Noise and Health
9. Seminars in Hearing
10. Hearing Aid Journal of India
11. International journal of Audiology
12. Hearing Research
13. Journal of American Audiology and Association
14. Journal of Association of Research in Otolaryngology
15. Volta Review
16. Journal of Cochlear Implant
17. Indian Journal of Otolaryngology
18. Journal of Indian Speech & Hearing Association
19. Journal of All India Institute of Speech and Hearing
- 20. Science @direct**

## CLINICAL PRACTICUM IN AUDIOLOGY

1. The operation of all the equipments used for evaluation and calibration.
2. Thorough in administration and interpretation of all special tests.
3. Explanation of atypical findings and differentiation between artifacts and atypical findings.
4. Trouble shoot the audiometer and ability to rectify independently.
5. Be familiar with recording and interpreting auditory evoked potentials such as MLR, LLR and P 3000. Evaluate and trouble shooting of hearing aids.
6. Be able to suggest ways of modifying electroacoustic output of hearing aids to suit the needs of the patient.
7. Have Knowledge in and assist in carrying out insertion gain measurement.
8. Counseling the client /Parent? regarding home training /hearing aid care/speech reading and auditory training.
9. Trouble shooting of hearing aids. To apply knowledge of electroacoustics for classification of hearing aids and recommendation for different types of patients.

In addition to clinical examination, evaluation and management in terms of choice is specificity of the procedures used, they shall comply with the following specific requirements:

1. Preparing audio cassettes for increasing public awareness with respect to profession and counseling of the case and or SOPs.
2. Comparison of behavioral and biophysical evaluation of hearing on two normal individuals and one each of conductive and sensori neural loss.
3. Comparison of psychoacoustic and objective evaluations of hearing aids in two individuals ( one child and one adult with hearing impairment).
4. Improving public awareness in the profession by paying visits to schools talking to X and XII standard students regarding students the profession and orienting other professional groups i.e. pediatricians, neurologists, GP etc.
5. Screening programs in schools.
6. One detailed report ( in a Formal format for journal publication) in one of the following categories A. Diagnostic B. Hearing Aid Evaluation C. Other Rehabilitative Management.

## **Objectives**

### **First year Post Graduate course**

#### **Audiology**

The students will be aware of

1. The psychological methods of hearing assessment
2. The applications of loudness scaling in clinical Audiology
3. Methods of measuring different sensitivity and their clinical applications
4. Pitch, quality/timbre measurements
5. Issues involved in masking and its application
6. Relevance of adaptation, fatigue, temporal perception and binaural hearing in audiological evaluation and management
7. The role of different parts of the auditory system in the perception of the different parameters of sound
8. The anatomy and physiology of the vestibular system.

## Second year Post graduate course

### Audiology – Objectives

At the end of the student should benefit to do the following

1. Understand the acoustics of speech, theories of speech perception, methods used to study speech perception
2. Understand the perception of speech through visual, tactile and cochlear implant modes
3. Know the methods of predicting and measuring speech intelligibility, factors affecting speech intelligibility
4. Understand the issues involved in the perception of speech in the hard of hearing and knows the relevance of the same in their evaluation and management
5. Understand the issues in processing of phonological, morphological syntactic, semantic and pragmatic aspects of language
6. Trouble shoot maintain and calibrate audiological ( diagnostic as well as rehabilitative) instruments, aids and appliances
7. Undertake hearing screening by opting for appropriate tools and techniques for various populations
8. Prepare comprehensive audiological evaluation reports after undertaking the indicated evaluations, incorporating the non-audiological reports for various types of disorders
9. Hearing assessment (diagnostic and rehabilitative) of special population such as deaf, blind, MR, cerebral palsied others
10. Hearing assessment and management of cases with Central Auditory processing disorders
11. Evaluation of patients with Vestibular disorders, tinnitus and functional hearing loss
12. Selections of approximate amplification for infants/children, adults, geriatric population. Evaluation of the amplification system
13. Identifying patients for implantable aids their assessment and post implant management
14. Guide the patients for their overall rehabilitation i.e auditory speech/language training educational placement
15. Aware of the process, care and issues in disability evaluation and certification.



**MINIMUM INFRASTRUCTURAL FACILITIES**

	Minimum Infrastructural Facilities (Recruitment preferably as per UGC norms)	Upto 20(Graduate) & upto 15(PG) students)		Upto 40(Graduate) & upto 20(PG) students)		B.Sc + M.Sc Aud	B.Sc + M.Sc SLP	upto 40 graduate & upto 20 PG students each in M.Sc Aud & M.Sc SLP
		Graduate (upto 20 students)	Graduate & PG (upto 20+15 students)	Graduate (upto 40 students)	Graduate & PG (upto 40+20 students)	upto 20 PG	upto 20 PG	
a.	Full time		1	1	1			1
	Professor or equivalent	1	1	1	1	1	1	2
	Reader or equivalent	1	1	1	2	1	1	2
	Lecturer	4	6	3	3	3	3	3+3+3
	Speech Pathologist / Audiologist(Grade I) (Clinical Supervisor)	2	4	4	4+4	2	2	4+4
	Speech Pathologist/ Audiologist(Grade I)	2	2	2	2	2	2	2
	Lecturer in Clinical Psychology - Part time	1	1	1	1			1
	Lecturer in ENT - Part time	1	1	1	1			1
	Lecturer in Linguistics - Part time	1	1	1	1		1	1
	Electronic Engineer	1	1	1	1	1	1	1
	Ear mould Technician	1	1	1	1			1
Librarian/Staff	1+1	1+1	1+1	1+1	1+1	1+1	1+1+1	
b.	Visiting faculty for Anatomy and Physiology	1	1	1	1			1
	Part time basis Lecturer in Statistics & Research	1	1	1	1	1	1	1

NOTE:



c)	Room for case history, Speech Diagnostic Room and Interviews	(10'x12')	3	5	8 Cubicles (6" x 7")	8	10	10	10	12
d)	Speech Lab (Quiet room for diagnostic purposes)	(15 x 20)	1	1	(15 x 20) Speech lab (Quiet room) for diagnostic purposes. Recording room(sound proof)	1	1		1	1
e)	Recording room (sound proof)	(10 x 10)		1		1	1		1	1
f)	Speech therapy rooms/Cabins	(8 x 8)	12 to accommodate 50% of the students	12	(8 x 8)	12	16	12+4	12+4	12+4+4
h)	* Single sound treated rooms, * Two Room Audiometric suited with control and test room situation (Sound Proof. ANSI 1977)	(10 x 18)	2	3	(8x 8) (10 x 6) outer (10 x 10) inner	2 1 1	3 2 2			

i)	Control and test room for hearing aid trial combination purpose	(10 x 15)	1	1	(10 x 15)	1	1			
j)	Ear mould lab	(15 x 20)	1	1	(15 x 20)	1	1			
k)	Staff room	(15 x 20)	1		Individual staff room with toilet (8 x 8)	4	8			
l)	Individual work space (with provision for storage facilities)	(10 x 10)	4	12						
m)	Library (Quiet Room)	(30 x 20)	2	2	Library (quiet hall) (30 x 50)	1	1			
n)	Hearing Aid Repair Lab		1	1	(10 x 8)	1	1			
o)	Principal's Office room		1	1		1	1			
p)	Sanitary facilities				Sanitary facilities separately for men and women					
q)	Arrangement for Hostel for Men and Women to accommodate at least 50% of the student population									
r)	Administrative Staff room				(10 x 10)					

Barrier free environment is mandatory



## EQUIPMENT

Sl.no	Equipment	Upto 20(Graduate) & upto 15(PG students)		Upto 40(Graduate) & upto 20(PG students)		B.Sc + M.Sc Aud	B.Sc + M.Sc SLP	upto 40 graduate & upto 20 PG students each in M.Sc Aud & M.Sc SLP
		Graduate (upto 20 students)	Graduate & PG (upto 20+15 students)	Graduate (upto 40 students)	Graduate & PG (upto 40+20 students)	upto 20 PG	upto 20 PG	

**Audiology**

a)	2 channel Diagnostic Audiometer with accessories such as earphone, ear cushion combination with adjustable headband, B.C vibrator, transducer like microphone and matching loud speakers	1 for each control + test room combination	1 for each control + test room combination	1 each for every 20 students control + test room combination	1 each for every 20 students control + test room combination	1 suite extra for dissertation research purpose	as required for B.Sc	1 suite extra for dissertation research purpose
b)	Portable audiometer with provision of A.C and B.C testing :desirable screening audiometer	1 for each test room	1 more	1 each for every 20 students in each test room	1 each for every 20 students	1 each for every 20 students		1 each for every 20 students
c)	Clinical Immitance Audiometer (desk model) with accessories.	2 instruments essential preferably one with screening type for field work	1 more	2 instruments essential preferably one with screening type for field work	2 instruments essential preferably one with screening type for field work	2 instruments essential preferably one with screening type for field work		2 instruments essential preferably one with screening type for field work

d)	Portable/screening Impedence, audiometer	1	1	1	1	1	1
e)	Clinical ABR ASSR Equipment for ERPs/LLR	1	2	2	2	2+1(ABR+ASSR or ABR+ ERPs)	2
f)	Otoacoustic emission	1	2	2	2	2	2
g)	Calibration equipment for AC, BC, and free field (by possession or access)	essential	essential	essential	essential	essential	essential
h)	Different types of hearing aid of mild, moderate, and strong categories body level and ear level, canal and spectacle hearing aids (1 each), FM, Digital, Programmable aids, ILS, assistive listening devices	A representative sample of hearing aids and assistive devices		A representative sample of hearing aids and assistive devices	A representative sample of hearing aids and assistive devices	A representative sample of hearing aids and assistive devices	A representative sample of hearing aids and assistive devices
i)	IGO and HAT for hearing aid trial and making electroacoustic measurements	1	1	1	1	1	1
j)	Stop watch	2	2	2	2	2	2
k)	Otoscope	2	2	2	2	3	3
l)	Proformae						

m)	Auditory training and screening material						
n)	Ear mould lab fully equipped for each centre						
o)	Tape recorder	1	1 + 1 digital	2	2+1DIGITAL	2+1DIGITAL	2+DIGITAL
p)	Software for therapy	1	1	1	1	1	1
q)	Computer		1	1	2	3	3
r)	Statistics software				1	1	1
s)	Audio visual lab preferable						

## EQUIPMENT

Sl.no	Equipment	Upto 20(Graduate) & upto 15(PG) students)		Upto 40(Graduate) & upto 20(PG) students)		B.Sc + M.Sc Aud	B.Sc + M.Sc SLP	upto 40 graduate & upto 20 PG students each in M.Sc Aud & M.Sc SLP
		Graduate (upto 20 students)	Graduate & PG (upto 20+15 students)	Graduate (upto 40 students)	Graduate & PG (upto 40+20 students)	upto 20 PG	upto 20 PG	

**Speech Pathology**

a)	Speech and Language tests(tests for differential diagnosis -English and local language)					as per BSc requirements		
b)	Proformae							
c)	Speech therapy material (Indian language and English)							
d)	Toys and books							

e)	Mirrors - size 2' x 3'	4	6	4	6	6	6	6
f)	Speech Trainer	1	2	6	6	6	6	6
g)	Portable and digital tape recorders	4	4+1digital	6	6+1digital		6+4 digital	6+4digital
h)	Hi-Fi Amplides with speakers and good microphone	1	2	2	2	2	2	2
i)	Expirograph/Aerophone	1	1	1	1	1	1	1
j)	Computer PC-AT with VGA Color monitor	1	2	2	2	2	2	2
k)	Software for diagnostic/therapeutic use SSL,CSL,VAGHMI etc							
l)	EGG	1	1	1	1	1	1	1
m)	Stop Watch	2	4	4	4	4	4	4
n)	Audio cassettes for training/CDs							
o)	Pitch Pipe							
p)	Tongue depressors							

**ANNEXURE - 1**  
**M.SC (AUDIOLOGY) SEMESTER SCHEME**

Sem	Code no	Paper Title	Theory hrs/week	Total no of theory hrs/sem	Pract Hrs/week	Durati on of exam hrs	Theory	CE	TOTAL
I	Aud 101	Research Methods and Statistics in Speech Language Hearing Sciences	04	52	15	3	80	20	100
	Aud 102	Instrumentation for Speech Language & Hearing Sciences	04	52		3	80	20	100
	Aud 103	Auditory Physiology	04	52		3	80	20	100
	Aud 104	Psychoacoustics (Part-I)	04	52		3	80	20	100
	Aud 105	Clinical Practicum (Internal)				3	80	20	100

II	Aud 201	Neurophysiology of Hearing	04	52	15	3	80	20	100
	Aud 202	Psychoacoustics (Part – II)	04	52		3	80	20	100
	Aud 203	Medical Audiology	04	52		3	80	20	100
	Aud 204	Seminars in hearing assessment	04	52		3	80	20	100
	Aud 205	Clinical Practicum (Internal + External)					50	50	100
III	Aud 301	Speech Perception (Part –I)	04	52	15	3	80	20	100
	Aud 302	Physiological Assessment of Hearing	04	52		3	80	20	100
	Aud 303	Listening Devices for the hearing impaired	04	52		3	80	20	100
	Aud 304	Advances in Management of the hearing impaired	04	52		3	80	20	100
	Aud 305	Clinical Practicum (Internal)					80	20	100
IV	Aud 401	Auditory Processing Disorders	04	52	05	3	80	20	100
	Aud 402	Audiology in Practice	04	52		3	80	20	100
	Aud 403	Speech Perception (Part – II)	04	52		3	80	20	100
	Aud 404	Dissertation (Internal + External)					100		100
	Aud 405	Clinical Practicum (Internal + External)				15		50	50

Note : I & III Semester will have Internal VIVA & II & IV Semester will have External VIVA, Candidates shall begin Dissertation work in III Semester.

- Dissertation will be evaluated by one internal & one external examiners for 100 marks each and an average shall be awarded to the candidate.

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