



# **Master of Science (Audiology)**

## **M.Sc. (Aud)**

**Rules, Regulations and Curriculum Framework**

**Effective from Academic Session 2024-25**

**Two Years Duration**

**REHABILITATION COUNCIL OF INDIA**  
*(Statutory Body of the Ministry of Social Justice & Empowerment)*  
Department of Empowerment of Persons with Disabilities (Divyangjan)  
Government of India  
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## **Preamble**

The rehabilitation Council of India, the apex body entrusted with the responsibility of maintenance of standards in the training of rehabilitation personnel and professionals in India, periodically undertakes revision of curriculum of its training programs. There was a sense of urgency in this year's proposal for revision because the components of the New Education Policy 2020 – the flagship program of the Government of India – had to be incorporated. The present revision has included many salient features of the NEP 2020, namely, major – minor subjects dimension, choice of subjects across multidisciplinary fields of study, ratio of theory to clinical/practical subjects and the credits system, to name a few. The present revision has also considered and included aspects of National Credit Framework, 2023 of UGC. The prospective students have to log in 80 credits, spread over major, minor, and clinical subjects, for a Master's degree in Audiology

In addition, the guidelines recommended by the National Medical Commission under Graduate Medical Education Regulations 2023 to define the profile of the trained graduates in the field have been adopted. The program objectives have been tuned to reflect this.

## **Rules, Regulations and Curriculum 2024-25 (Semester Scheme)**

### **1.0 Name of the Program Offered**

The nomenclature of the program shall be Master of Science (Audiology). M.Sc (Aud) shall be the short form.

### **2.0 Objectives of the M.Sc (Aud) Program**

The objectives of the M.Sc (Aud) program are to equip the students with knowledge and skills to

- a) function as teachers in institutions of higher learning,
- b) undertake research in audiology and related areas,
- c) diagnose and manage disorders of hearing and hearing-related vestibular disorders across life span,
- d) follow and guided by evidence-based practice
- e) understand the socio-cultural aspects relating to hearing issues in the community,
- f) implement rehabilitation programs for persons with hearing, and vestibular disorders,
- g) function as disability certification authority in hearing,
- h) educate and empower persons with hearings disorders on government policies, services to Divyangjan, and on medico legal issues
- i) liaise and communicate with professionals in allied fields
- j) advice the government on policy issues relating to hearing issues,
- k) establish and administer institutions of higher learning.
- l) implement public education programs on hearing health

### 3.0 Duration of the Program

- a) The program shall be of 4 semesters (2 academic years).
- b) Students have to successfully complete the program within 4 years from the date of admission.
- c) An academic year consists of two semesters, and each semester shall extend over a minimum period of eighteen weeks excluding examination days. The semester spread shall be as follows:

Odd semesters – 1, 3	July - November
Even semesters – 2, 4,	January - May
Examinations and vacation	December and June

- d) There shall be examination at the end of each semester.

### 4.0 Medium of Instruction

Medium of instruction shall be English.

### 5.0 Eligibility for Admission

- 5.1 Candidates with BASLP/B.Sc (Speech & Hearing) degree of any university recognized by the Rehabilitation Council of India with a minimum of 55% marks in aggregate.
- 5.2 Admission to Master's program shall preferably be on the basis of an entrance examination conducted by the respective university.

### 6.0 Time Structure of the Program

Time structure of the program shall be as follows:

Months / Semester	6
Weeks / Semester	26 weeks
Examination + Vacation	8 weeks in each semester
Study duration in each semester	18 weeks
Days per week / Semester	5 days / 90 days
Hours / day / Semester	7 hours / 630 hours per semester

### 7.0 Attendance

- 7.0 Attendance shall not be less than 80% in theory and 90% in clinicals in each semester for students to be eligible to appear for examination at the end of each semester.
- 7.1 Students not meeting the attendance requirements shall not be allowed to take examination in the particular paper with shortage of attendance and will be marked 'failed.' Such students can take the exam in that particular paper in the next odd or even semester as the case may be.

## 8.0 Examination Pattern

8.1 The examination pattern and papers shall be as shown in the table below:

Code	Subject	Marks			Credits
		Exam	IA	Total	
Aud 101 M	Auditory Physiology	80	20	100	4
Aud 102 M	Physiological Assessment of Hearing	80	20	100	4
Aud 103 MC	Research Methods, Epidemiology & Statistics	80	20	100	3
Aud 104 MC	Technology in Audiology	80	20	100	3
Aud 105 MO	Minor Optional	40	10	50	1
Aud 106 M	Clinicals in Audiology	80	20	100	6
		<b>440</b>	<b>110</b>	<b>550</b>	<b>21</b>
Aud 201 M	Hearing Sciences	80	20	100	4
Aud 202 M	Auditory Disorders	80	20	100	4
Aud 203 M	Advances in the Management of Auditory Disorders	80	20	100	4
Aud 204 MC	Advances in Pediatric Audiology	40	10	50	2
Aud 205 MC	Geriatric Audiology	40	10	50	2
Aud 206 MO	Minor (Optional)	40	10	50	1
Aud 207 M	Clinicals in Audiology	80	20	100	6
		<b>440</b>	<b>110</b>	<b>550</b>	<b>23</b>
Aud 301 M	Auditory Implants	80	20	100	4
Aud 302 M	Vestibular System & its Disorders	80	20	100	4
Aud 303 MC	Genetics of Hearing	40	10	50	2
Aud 304 M	Clinicals in Audiology	80	20	100	6
		<b>280</b>	<b>70</b>	<b>350</b>	<b>16</b>
Aud 401 M	Speech Perception	80	20	100	4
Aud 402 M	Dissertation	100	00	100	10
Aud 403 M	Clinicals in Audiology	80	20	100	6
		<b>260</b>	<b>40</b>	<b>300</b>	<b>20</b>
		<b>1420</b>	<b>330</b>	<b>1750</b>	<b>80</b>

8.2 Course content shall be as in Annexure 1

8.3 The students shall successfully complete 80 credits, as shown below, to be eligible for the award of the degree of Master of Science (Aud).

Major (M)	Audiology	Theory	32 credits
Major (M)	Audiology	Clinicals	24 credits
Minor Compulsory (MC)	Related Areas		12 credits
Minor Optional (MO)	Related Areas		2 Credits
Dissertation			10 Credits
Total			80 Credits

8.4 Performance in at least one written test and one assignment shall be the basis for awarding 50% internal assessment marks in each semester. The remaining 50% of

IA shall be awarded on the basis of continuous assessment by the faculty teaching a given subject. Each institute can develop its own criteria for continuous assessment.

- 8.5** Award of IA marks for Clinical (Internals) – Aud 106 and Aud 304 as well as Clinical (External) – Aud 206 and Aud 403 – shall be on the same basis as described under 8.4 above. However, all the faculty/clinical staff members in charge of clinicals for the given semester shall award marks, respectively.
- 8.6** Examinations for Minor Optionals (Aud 105 and Aud 206) as well as Clinical Internals (Aud 106 and Aud 304) shall be conducted by the institution, but the marks awarded shall be included in the university marks card.
- 8.7** Two internal examiners (nominated by head of the department / institution from among the faculty of the department) shall conduct the clinical examinations (for Aud 106 and Aud 304) at the end of 1<sup>st</sup> and 3<sup>rd</sup> semester.
- 8.8** An external examiner shall conduct the clinical examinations for Aud 206 and Aud 403 at the end of the 2<sup>nd</sup> and 4<sup>th</sup> semester, respectively. All the faculty of the department shall award IA marks on the basis of the assessment of the candidates' work throughout the particular semester. Clinical examination shall be with clinical population and with audio / video records of clinical samples. The examiners shall also evaluate records of clinical and practical work of the students. An internal faculty member can assist the external examiner(s) in Clinicals (External) (Aud 206 and Aud 403), but shall not award marks.
- 8.9** The institutions offering M.Sc (Aud) program are free to design the curriculum of the minor (optional) courses listed below:

Auditory Processing Disorders  
Bioethics  
Entrepreneurship  
Event Related Potentials  
Genetics of Speech-language  
Learning Disability  
Oncology & Speech Swallow Disorders  
Pharmacology  
Speech Production and Analysis  
Speech Science  
Teaching Learning in Audiology

## **9.0 Dissertation**

- 9.1** Students shall complete a dissertation in the 3<sup>rd</sup> and 4<sup>th</sup> semester of the course and shall submit the same at the end of 4<sup>th</sup> semester before final examination. The dissertation shall be the result of experimental research. One or more external examiners shall assess the dissertation for 100 marks as per the policy of the respective university.
- 9.2** Candidates who fail to submit their dissertation on or before the stipulated date shall not be permitted to appear for the final semester examination.

## **10.0 Criteria for Passing**

- 10.1** The student is required to obtain a minimum of 50% in each of the theory papers, internal assessment, clinicals, and dissertation for a pass.
- 10.2** Students will have to pass the clinical examination of the given semester to proceed to the next semester.
- 10.3** Carry-over of papers: Maximum number of attempts for any paper / clinical practicum / dissertation shall be three inclusive of first attempt.

## **11.0 Board of Examiners**

- 11.1** There shall be a Board of Examiners for scrutinizing and approving the question papers as well as scheme of valuation
- 11.2** Fifty percent of the members in the Board of Examiners shall be from outside the institution.

## **12.0 Award of Degree**

The University shall award the degree and issue certificate only after the candidates successfully complete all the examinations stipulated.

## **13.0 Infrastructure for Starting the Course**

Institutions who have the infrastructure as given in Annexure 2 shall be permitted to offer Masters' program in Audiology, after due formalities.

## **14.0 Others**

- 14.1 Registration at Rehabilitation Council of India:** Successful postgraduates will be registered as Audiologists in the Central Rehabilitation Register of the Rehabilitation Council of India with additional qualification.
- 14.2** On all other issues not mentioned in these rules and regulations like the pattern of question paper, grading, award of grace marks, and declaration of rank, among others, the rules and regulations of the respective University shall prevail.
- 14.3** These revised rules and regulations, guidelines and curriculum shall override all other rules and regulations in force. These rules and regulations shall come into force from the academic year 2024-25.

**Course Content : 2-year M.Sc (Aud) Program**

**Semester 1**

**Aud 101 M : Auditory Physiology**

**Hours 60**

**Marks 100 : Credits 4**

**Objectives:** After completing this course, the student shall be able to

- a) identify and describe the macro- and microanatomic structures of the peripheral as well as central auditory system
- b) describe the physiology of peripheral as well as central auditory system
- c) institute methods to study the physiology of the different components of the auditory system, and
- d) apply the knowledge of auditory physiology to take appropriate clinical decisions.

**Unit 1: Anatomy and Physiology of Outer and Middle Ear**

- a) Anatomy of external ear
- b) Resonance properties of external ear and its significance to hearing and sound localization
- c) Head related transfer function (HRTF)
- d) Bone conduction hearing: theories, factors affecting, skull properties
- e) Anatomy of Middle ear and middle ear cleft
- f) Middle ear transformer action

**Unit 2: Cochlear Anatomy and Physiology**

- a) Macro & microanatomy of cochlea
- b) Innervations and Blood supply to cochlea
- c) Cochlear fluids: Generation, composition, and dynamics
- d) Cochlear transduction and electrophysiology, Cochlear potentials their generation and properties.
- e) Basilar membrane mechanics and non-linearity
- f) Hair cell micromechanics and nonlinearity
- g) Proteins and nutrients related to cochlear physiology
- h) Hair cell regeneration

**Unit 3: Anatomy and Physiology of the Auditory Nerve**

- a) Structure and tonotopic organization of VIII cranial nerve
- b) Action potential: Generation, properties and conduction
- c) Physiology of the auditory nerve:
  - Non-linearity seen at auditory nerve.
  - Stimulus coding - frequency, intensity and temporal coding.
  - Coding of complex signal at the auditory nerve



- d) Synapse: Neuro-transmitters vs. neuro- modulators, properties and function of neuro-transmitters, afferent and efferent neuro-transmitters

#### **Unit 4: Anatomy and Physiology of Auditory Brainstem and Subcortical Regions**

- a) Auditory nuclei and their interconnections
  - Cochlear nucleus
- b) Superior olivary complex
- c) Lateral lemniscus
- d) Inferior colliculus
- e) Medial geniculate body
- f) Tonotopic organization
- g) Coding of signals at brainstem and subcortical levels
  - Simple and complex signals
  - Speech
  - Role in sound localization
- h) Role of brainstem in sound localization
- i) Application in understanding concerned auditory disorders

#### **Unit 5: Anatomy and Physiology of the Auditory Cortex and Efferent Pathway**

- a) Anatomy of primary and secondary auditory cortex
- b) Tonotopic organization
- c) Neurobiological relationship between auditory cortex and other cortical areas
- d) Coding of signals in auditory cortex
  - Simple and complex signals
  - Speech
  - Role in sound localization
- e) Efferent auditory pathways: olivocochlear bundle, corticofugal pathway, cortico-cortical connections
- f) Physiology of auditory efferent pathways and its influence on auditory physiology
- g) Application in understanding concerned auditory disorders

#### **Recommended Reading**

- a) Altschuler, R. A., & Hoffman, D. W. (1986). Neurobiology of hearing: the cochlea. New York: Raven Press.
- b) Tony, L., Sahley., Richard, H., Nodar., Frank, E., Musiek. (1997). Efferent Auditory System: Structure and Function.
- c) Dallos, P. (1973). Auditory periphery: Biophysics & physiology. New York: Academic Press.
- d) Drescher, D. G. (1985). Auditory biochemistry. Springfield: Charles C. Thomas.
- e) Gelfand, S. A. (2004). Hearing: Introduction to Psychological and Physiological Acoustics. (4th Edn.). New York: Marcel Decker.
- f) Gulick, W. L., & Others. (1989). Hearing: Physiology, acoustics, neural coding & psychoacoustics. New York: Oxford University Press.
- g) Günter, E., & Romand, R. (1997). The central auditory system. United Kingdom: Oxford University Press.
- h) Jahn, A. F., & Santos-Sacchi, J. (1989). Physiology of the Ear. New York: Academic Press.

- i) Moller, A. R. (2000). Hearing: Its physiology and pathology. San Diego: Academic Press.
- j) Pickels, J.O. (2012). An introduction to the physiology of hearing. United Kingdom: Emerald Group Publishing Inc.
- k) Richard, A. (1991). Neurobiology of Hearing. USA: Raven Press.
- l) Zemlin, W. R. (1998). Speech & Hearing science: Anatomy & Physiology. Boston: Allyn & Bacon.

## Aud 102 M : Physiological Assessment of Hearing

**Hours 60**

**Marks 100 : Credits 4**

**Objectives :** After completion of this course, the students will be able to

- a) administer multi component/frequency tympanometry, wideband tympanometry and advanced OAE tests , and interpret the results,
- b) record different auditory evoked potentials and describe their clinical applications and generator sites.
- c) Choose the appropriate AEP tp record in any given clinical situation, and
- d) set the parameters for recording and analyzing various AEPs.

### **Unit 1: Middle Ear Immittance Measures and Otoacoustic Emissions**

- a) Middle ear immittance measures: multicomponent & multifrequency tympanometry, wide band tympanometry, reflexometry
- b) Otoacoustic emissions:
  - Cochlear mechanisms in the generation of OAEs
  - The influence of ear canal acoustics and round trip gain of middle ear
  - mechanism based taxonomy of OAE
  - Stimulus frequency OAEs, methods of recording, its applications
  - Fine structure OAEs and its applications
  - Suppression of OAEs: ipsilateral, contralateral, and bilateral

### **Unit 2: Principles of Recording AEPs**

- a) Stimuli for recording AEPs and the various stimulus paradigms used for AEP recording
- b) Neurophysiological mechanism: electrical dipole, action potential versus post synaptic potentials, open versus closed neural circuitry, volume conduction, scalp distribution
- c) Acquisition of EEG signal
  - Common mode rejection
  - A/D conversion
  - Amplification
  - Antialiasing filter
- d) Signal processing techniques
  - Analog filters & digital filters
  - Time locked acquisition
  - Amplitude based techniques for artifact rejection
  - Unweighted and weighted time domain averaging
  - Unweighted and weighted frequency domain averaging
- e) Rationale for nomenclature and generators of auditory evoked potentials
- f) Continuous acquisition of EEG
- g) High density EEG recording
- h) Recording AEPs for intraoperative monitoring

### **Unit 3: Early AEPs**

- a) Acquisition, analysis and applications of

- Electrocochleography
- Chirp evoked ABRs
- Frequency specific ABRs
- CHAMP
- Stacked ABRs
- Complex ABRs
- EABR

#### **Unit 4: Middle and Late Latency AEPs, Auditory Steady State Responses**

- a) Acquisition, analysis and applications of
  - middle latency responses
  - frequency following responses and envelope following responses
- b) Factors influencing middle latency responses: Stimuli related, acquisition related, subject related
- c) Acquisition, analysis and applications of
  - Auditory steady state responses
- d) Factors influencing late latency responses: Stimuli related, acquisition related, subject related Acquisition, analysis and applications of
  - late latency responses (P1, N1, P2, N2)
  - ACC

#### **Unit 5: Endogenous AEPs**

- a) Overview of endogenous potentials
- b) Acquisition, analysis, factors affecting and application of
  - MMN
  - P300
  - N400
  - P600
  - CNV
  - Other endogenous potentials
- c) Multi-modality stimulation
- d) Special techniques involved in acquisition and analysis of endogenous potentials

#### **Recommended Reading**

- a) Burkard, R.F., Don, M., & Eggermont, J.J. (Eds.) (2007). Auditory Evoked Potentials: Basic Principles & Applications. Baltimore: Lippincott Williams & Wilkins.
- b) Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson.
- c) Hall, J.W., & Mueller, H.G. (1997) Audiologists' Desk Reference. Volume 1: Diagnostic Audiology Principles, Procedures and Protocols. San Diego: Singular Publishing Group.
- d) Hood, L.J. (1998). Clinical applications of auditory brainstem response. San Diego: Singular Publishing Group Inc.
- e) Katz, J. (Ed.). (1994). Handbook of Clinical Audiology. Baltimore: Williams and Wilkins.
- f) Kilney, P.R. (2017). Audiologists handbook of intraoperative neurophysiological monitoring. San Diego: Plural Publishing Group

- g) Krishnan, A. (2021). Auditory brainstem evoked potentials: Clinical and research Applications. San Diego: Plural Publishing Group
- h) Markand, O. N. (2020). Clinical Evoked Potentials: An Illustrated Manual. Springer Nature.
- i) McPherson, L.D. (1995). Late potentials of the auditory system. London: Singular Publishing Group.
- j) Picton, T. (2011). Human Auditory Evoked Potentials. San Diego: Plural Publishing Group.
- k) Rance, G (2008). Auditory Steady State Responses. San Diego: Plural Publishing Group

## Aud 103 MC : Research Methods, Epidemiology & Statistics

**Hours 45**

**Marks: 100 - Credits: 3**

**Objectives:** After completing this course, the student will

- a) have the skills to frame research questions and design experiments,
- b) decide on the appropriate statistical methods to test hypotheses and interpret the results,
- b) be aware of epidemiological issues and its relevance in hearing research,
- c) undertake evidence based practice in audiology, and
- d) observe ethical practices in research

### **Unit 1: Experimental Designs and Their Applicability in Hearing Research**

- a) Types of research- post facto, normative, standard group comparison, experimental research, clinical and applied research, sample surveys, evaluation research
- b) Methods of observation and measurement, strategies and designs in research
- c) Experimental designs, single subject designs and group designs
- d) Critical analysis of the research methods employed in audiology.
- e) Documentation and research writing
- f) Ethical considerations in research – National and international guidelines

### **Unit 2: Epidemiology**

- a) Epidemiology: Definition, basic concepts – scope and function of epidemiology
- b) Study designs in epidemiology: Cohort studies, case-control studies, cross-sectional studies, clinical trials
- c) Measures in epidemiology – Ratios, proportions, rates, relative risk, odds ratio
- c) Identify biases and their consequences in published literature.
- d) Describe criteria for characterizing the causality of associations.
- e) Application of epidemiological concepts in evaluation and screening procedures employed in audiology
- f) Application and impact of epidemiology on national and local policy; influence of epidemiology on ethical and professional issues

### **Unit 3: Statistical Measures and Their Features**

- a) Review of data description and exploratory data analysis (Numerical and graphical summaries)
- b) Probability concepts and models
- c) Statistical Inference – Estimation Confidence Intervals
- d) Statistical Inference – Basic concepts related to hypothesis testing – null hypothesis, alternative hypothesis, significance level, statistically significant, critical value, acceptance / rejection region, p-value, power, types of errors: Type I ( $\alpha$ ), Type II ( $\beta$ ), one-sided (one-tailed) test, Two-sided (two-tailed) test
- e) Parametric and non-parametric approaches to hypothesis testing
- f) Categorical data analysis - contingency tables, Chi-square test for independence of attributes
- g) Measures of association (Contingency coefficient, Cramer's V), Kappa coefficient

#### **Unit 4: Regression, Univariate and Multivariate Analysis**

- a) Correlation, regression analysis and prediction including multiple regression; logistic regression; path analysis
- b) Analysis of Variance (ANOVA)- Basic models, assumptions, one way and two way ANOVA; Consequence of failure of assumptions underlying ANOVA; Tests for additivity, homogeneity, transformation; Post – hoc tests; Analysis of Covariance (ANOCOVA); Repeated measure ANOVA
- c) Multivariate analysis: Need for multivariate analysis, various methods including MANOVA, MANCOVA
- d) Introduction to principal component analysis, factor analysis, discriminant function, multidimensional scaling
- e) Evaluation of application of statistics to different research designs used in different publications
- f) Critical analysis of research articles in the field: Analysis of research designs in different areas of Speech-language Pathology

#### **Unit 5: Evidence Based Practice**

- a) Introduction to Evidence Based Practice (EBP) and Steps to EBP from formulating foreground question, finding best current evidence, critical appraisal of best current evidence, summarizing evidence, integrating evidence and tracking progress.
- b) Concepts related to practical significance (effect size) vs. statistical significance, precision of measurement (confidence intervals)
- c) Levels of evidence: For experimental and non-experimental designs; treatment efficacy- randomized control study, quasi experimental study, correlation and case study, single subject designs, expert committee report, consensus conference
- d) Measures of diagnostic accuracy – positive and negative likelihood ratios; positive predictive value, negative predictive value, diagnostic odds ratio
- e) Concepts related to randomized control trials: Comparative groups- allocation concealment / random allocation; importance of participation and follow up in understanding, evaluating and applying randomized controlled trial results
- e) Methods of carrying out therapy trials; execution, indexing and reporting of therapy trials – efficacy studies; Conventions to study outcomes - i) Absolute risk reduction, ii) Absolute benefit increase, iii) Absolute risk increase, and iv) Absolute benefit reduction
- f) Systematic review and meta-analysis; importance of research publications in terms of systematic review, meta-analysis, clinical practice guidelines, health technology assessments.
- g) Challenges in implementation of EBP in Speech-language Pathology in India and future directions

#### **Recommended Reading**

- a) Andy Field (2009). *Discovering Statistics Using SPSS*. (3rd Ed.). SAGE Publications
- b) Bernard Rosner. (2011). *Fundamentals of Biostatistics* (7th Ed.). Cengage Learning, Inc.
- c) David C. Howell. (2014). *Fundamental Statistics for the Behavioral Sciences* (8th Ed.). Jon-David Hague publishers.

- d) David L. Irwin, Norman J. Lass, Mary Pannbacker, Mary Ellen Tekieli Koay, Jennifer S. Whited (2020). Clinical research methods in speech-language pathology and audiology (3rd Edition), San Diego, CA: Plural Publishing.
- e) Hegde M. N. (2024). A course book on Scientific and professional writing for speech language pathology (6th Edition), San Diego, CA: Plural Publishing, Inc.
- f) Hegde, M. N. (2021). Clinical research in communicative disorders: Principles and strategies. (4th Edition), San Diego, CA: Plural Publishing.
- g) Kothari, CR (2004). Research Methodology- Methods & Techniques. (3rd Ed.). New Age International (P) Limited, Publishers.
- h) Lauren K. Nelson, Jaimie L. Gilbert (2021). Research in Communication Sciences and Disorders: Methods for Systematic Inquiry. (4th Edition), San Diego, CA: Plural Publishing.
- i) Sabine, Landau, Brian S. Everitt. (2004). A Handbook of Statistical Analyses using SPSS. Chapman & Hall/CRC Press LLC.
- j) Vinaya Manchaiah, Eldré W. Beukes, Ross J. Roeser (2022). Evaluating and Conducting Research in Audiology. San Diego, CA: Plural Publishing.
- k) Visweswara Rao, K (2010). Bio Statistics in Brief Made Easy. Jaypee Brothers Medical Publishers.
- l) Wendy L. Martinez, & Angel R. Martinez. (2002). Computational Statistics Handbook with MATLAB. Chapman & Hall/CRC Press LLC.



## Aud 104 MC : Technology in Audiology

**Hours 60**

**Marks 100 : Credits 4**

**Objectives:** After completing this course, the student will

- a) have the skills to acquire signals and process them
- b) develop and apply software based tools,
- c) develop and apply of tele-technology strategies, and
- d) decipher the technology of amplification devices

### **Unit 1: Transducers and Signal Processing**

- a) Transducers used in speech, language and hearing
  - Microphones: Basic structure & principle of operation of dynamic, condenser and electret microphones.
  - Essential characteristics of microphones for sound recording, sound measurement and hearing aids.
  - Loudspeakers: Basic structure & principle of operation of moving coil and balanced armature type.
  - Essential characteristics of headphones and insert receivers
- b) Digital signal processing (DSP)
  - Basic structure of a digital signal processing system
  - Analog to digital conversion and D to A conversion – influencing parameters
  - Basic concepts of digital signal processing: signal decomposition, processing and synthesis
  - Implementation of filters using DSP – FIR and IIR
- c) Speech signal processing
  - Converting a speech signal from time domain to frequency domain
  - Feature extraction using short time analysis techniques

### **Unit 2: Information and Communication Technology & Power Supply**

- a) Information and communication technology
  - Computer architecture
  - Role of operating system, RAM and hard disk in the performance of a computer
  - Implementation of computer networks in clinics
  - Basic structure of a satellite communication system
  - Cloud based computing
- b) Tele-practice
  - Technology for tele-diagnosis in audiology
  - Technology for tele-rehabilitation
- c) Applications of artificial intelligence and machine learning
- d) Power supply
  - Requirements for mains supply to clinics, electrical grounding – general and special, measures to reduce electro-magnetic interference (EMI)
  - Safety of medical electrical instrument – standards and classes, degree of protection
  - Uninterrupted power supply for entire clinic vs. individual instruments

### **Unit 3: Technology Involved in Hearing Aids, Cochlear Implants and Speech Processing**

- a) Technology involved in hearing aids
  - Basic architecture of digital hearing aids
  - Technologies for channel separation
  - Technologies for non-linear amplification
  - Technologies for noise suppression
  - Technologies for feedback cancellation
- b) Technology involved in cochlear implants
  - Basic architecture of a cochlear implant
  - Speech processing strategies
- c) Techniques of speech analysis
  - LPC analysis
  - Cepstrum analysis
- d) Applications of speech processing
  - Speaker recognition
  - Automatic speech recognition
  - Speech synthesis

### **Unit 4: Instrumentation in Hearing Science**

- a) Instrumentation in audiology
  - Audiometer
  - Middle ear analyzer
  - Otoacoustic emission analyzer
  - Instrumentation for auditory evoked potentials
  - Multichannel EEG and ERP systems
- b) Calibration and maintenance of Audiological equipment
  - Audiometer
  - Middle ear analyzer
  - Otoacoustic emission analyzer
  - Instrumentation for auditory evoked potentials
- c) Acoustic measurements
  - Sound level meter – concept of frequency weighting, averaging time
  - Noise auditing – traffic noise, ambient noise in audiometric test room and class rooms
  - Measurement of reverberation time

### **Unit 5: Software for Analysis**

- a) Software packages and applications in hearing diagnostics and research - MATLAB, Adobe audition, Audacity, PRAAT
- b) Basics features, vectors and matrices, built-in functions and plotting
- c) Editing audio files, applying effects in waveform editor, amplitude compression and modulation effects, filter and equalizer effects, noise reduction/ restoration effects, basic multi track controls, saving and exporting
- d) Computer based assessment and intervention programs relating to hearing

## Recommended Reading

- a) Silmaon, S., Emmer, M.B., Silverman, C.A. and Brody, A (2022). Instrumentation for Audiology and Hearing Science: Theory and Practice. Plural publishers.
- b) Moser, P. (2015). Electronics and Instrumentation for Audiologists. Psychology Press.
- c) Boulston, F. R. & Dvorak, J.D (2015). Matlab Primer for Speech Language Pathology and Audiology. San Diego: Plural Publishing Inc
- d) Villchur, E. (1999). Acoustics for Audiologists (1 edition.). San Diego, Calif: Delmar Cengage Learning.
- e) Baber, C. & Noyes, J.M. (1993). Interactive Speech Technology: Human Factors Issues in the Application of Speech Input Output to Computers. London: Taylor and Francis.
- f) Daniloff, R.G (1985). Speech Sciences: Recent advances. London: Taylor and Francis.
- g) Gottingen, M.R.S. (Ed.) (1985). Speech and Speaker Recognition. Basel: Kager.
- h) Haton, J.P. (Eds) (1981). Automatic speech analysis & recognition. USA, D. Reidel Publishing Company.
- i) Keller, E. (ed.) (1994). Fundamentals of Speech Synthesis and Speech Recognition: Basic Concepts, State of the art and Future challenges. New York: John Wiley & sons.
- j) Morgan, D.P. & Scofield, C.L (1991). NeuralNetworks and Speech Processing. Boston, Kluwer Academic Publishers.
- k) Nakagawa, S. &etal. (1995). Speech, Hearing and Neural Network Models. Oxford: IOS, Press
- l) Oppenheim & Schafer (1989). Digital signal processing. New Delhi: Prentice Hall of India.

### **Aud 1.5 MO : Minor Optional - 1**

**Hours 15**

**Marks 50 : Credits 1**

- a) Each participating institution can offer any of the following as minor optional. However, a course once offered shall not be repeated for the same batch.
- b) The institution itself can draw the syllabus for the course.
- Auditory Processing Disorders
  - Entrepreneurship
  - Genetics of Speech-language
  - Oncology & Speech Swallow Disorders
  - Speech Production and Analysis
  - Teaching Learning in Audiology
  - Bioethics
  - Event Related Potentials
  - Learning Disability
  - Pharmacology
  - Speech Science

## Aud 106 M : Clinicals in Audiology

**Hours 180+**

**Marks 100 : Credits 6**

### General Considerations

- a) The student should be able to carry out complete audiological evaluation and management of persons with hearing impairment.
- b) After completion of clinical postings, the student will have the ability to apply, show (in a clinical diary/log book), and perform the following on patients/clients:

### Knowhow

- a) Gather, review, and examine the information from referral sources to facilitate the audiological assessment process.
- b) Record BC ABR in case of Anotia and Atresia
- c) Perform ABR in anesthetized patient.
- d) Differentially diagnose among middle ear pathologies based on puretone audiogram and immittance evaluation
- e) To prepare referral letters

### Demonstrate

- a) Generation of stimuli for recording AEPs
- b) Modify protocols for recording ABR based on the client being tested
- c) Perform stacked ABR and CHAMP
- d) Analyze normal and abnormal auditory evoked potential waveforms.
- e) Perform bone conduction ABR with contralateral masking

### Do

- a) Record tympanogram in the manual mode and measure peak pressure, peak admittance and ear canal volume manually using cursor (10 cases).
- b) Interpret case results indicating the presence of various middle ear pathologies (25 cases)
- c) Vary different stimulus and procedure related parameters and note their effect on test results. For e.g., probe tone frequency, rate of pressure change, direction of pressure change, number of trials, probe insertion depth, sneezing before measurement, speaking while measurement (25 ears)
- d) Record acoustic reflexes and differentially diagnose auditory disorders based on the results of pure tone audiometry, speech audiometry and immittance evaluation (25 cases)
- e) Measure resonant frequency of middle ear and interpretation (25 cases)
- f) Perform tests of Eustachian tube functioning and interpret the status of ET (25 cases)
- g) Carry out Acoustic reflex decay test and quantify the decay (10 cases).
- h) Record electrocochleography and measure SP/AP amplitude and area ratio
- i) Record MLR, LLR, ACC, MMN, P300 and measure latency and amplitude of waves
- j) Carry out hearing aid trial selection (5 cases)
- k) Carry out therapy for children with hearing loss (5 cases)
- l) Carry out newborn hearing screening (10 babies)

## **Evaluation**

- a) Internal evaluation shall be based on attendance, clinical diary, log book and learning conference.

## Semester 2

### Aud 201 M : Hearing Sciences

**Hours 60**

**Marks 100 : Credits 4**

**Objectives:** After completing this course, the student will be able to

- a) understand psychophysical components of sound and their measurement,
- b) analyse and critically evaluate the different methods of estimation of thresholds, frequency analysis and application of masking, and
- c) conduct experiments to estimate thresholds, and measure pitch, loudness and temporal aspects.

#### **Unit 1: Introduction to Psychoacoustics**

- a) Physical properties of sound
- b) Theory of signal detection: Basic concepts and applications
- c) Psychophysical procedures
- d) Absolute and differential hearing sensitivity

#### **Unit 2: Loudness and Pitch**

- a) Loudness
  - Scales
  - Spectral, temporal and intensity effects
  - loudness perception in hearing impaired
  - Models of Loudness
- b) Pitch
  - Scales
  - Spectral (place) and temporal (rate) theories of pitch perception of simple and complex tones
  - Pitch perception in hearing-impaired

#### **Unit 3: Masking**

- a) Peripheral masking:
  - Critical band concept and power spectrum model
  - Estimating the shape of auditory filter: Psycho-physical tuning curve; Notched noise; Non-simultaneous masking
  - Auditory filter shapes in normal hearing and hearing impaired
  - Masking patterns and excitation patterns in normal hearing and hearing impaired
- b) Non-Peripheral masking:
  - Central masking
  - Informational masking
  - Co-modulation masking release
  - Effect of hearing loss on non-peripheral masking

#### **Unit 4: Temporal Processing**

- a) Concept of temporal processing: Temporal resolution, Temporal integration
- b) Methods to assess temporal resolution and factors affecting them: Gap detection and discrimination, temporal modulation transfer function, tests for temporal fine structure sensitivity
- c) Factors affecting temporal integration
- d) Models of temporal resolution and integration

#### **Unit 5: Spatial Perception and Auditory Scene Analysis**

- a) Basic principles of auditory localization and lateralization
- b) Cues for auditory localization: binaural cues, HRTFs, head movements
- c) Binaural release from masking
- d) Precedence effect
- e) Models of binaural hearing
- f) Auditory spatial perception abilities in hearing impaired
- g) Basic principles of auditory perceptual organization
- h) Perceptual cues for auditory grouping/segregation
- i) Models of auditory scene analysis

#### **Recommended Reading**

- a) Brain C.J., Moore (2007). Cochlear Hearing Loss: Physiological, Psychological and Technical Issues. England: John Wiley and Sons Ltd.
- b) Garrett, S.L. (2020). Understanding Acoustics: An Experimentalist's View of Acoustics and Vibration. (2nd edition). Springer.
- c) Gelfand, S, A. (2005). Introduction to psychological and physiological acoustics. New York: Marcel Dekker.
- d) Gullick, W.L. (1971). Hearing physiology and psychophysics. New York: Oxford University Press.).
- e) Howard, D and Angus, J ( 2013). Acoustics and Psychacoustics. Oxford: Taylor & Francis
- f) Lass, N.J. (2023). Hearing science fundamentals. (2nd Edition). Plural Publishing
- g) Mcdougal, N. (2022). Spatial Hearing and Auditory Perception. American Medical Publishers.
- h) Stuart Rosen and Deter Howell (1991). Signals and systems for speech and hearing. CA: Academic Press Inc
- i) Tan, S. L., Pfordresher, P., & Harré, R. (2017). Psychology of music: From sound to significance. (2nd edition). Routledge.
- j) Van Dijk, P., Başkent, D., Gaudrain, E., De Kleine, E., Wagner, A., & Lanting, C. (2016). Physiology, psychoacoustics and cognition in normal and impaired hearing. Springer Nature.



## Aud 202 M : Auditory Disorders

**Hours 60**

**Marks 100 : Credits 4**

**Objectives:** After completing this course, the student shall be able to

- a) explain the pathophysiology of auditory disorders
- b) assess and accurately diagnose auditory disorders, and
- c) recommend the most appropriate intervention strategy

### **Unit 1: Disorders of the External and Middle Ear**

- a) Aetiology, pathophysiology, audiological and non audiological profile, assessment methods (audiological & non-audiological) and intervention methods of
  - Congenital malformations of external and middle ear
  - Otitis media and its complications
  - Otosclerosis, neoplasms, ossicular chain discontinuity
  - Disorders of Eustachian tube
- b) Reconstruction of external and middle ear hearing mechanisms: reconstructive and rehabilitation procedures

### **Unit 2: Disorders of the Cochlea**

- a) Aetiology, pathophysiology, audiological and non audiological profile, assessment methods (audiological & non-audiological) and management of
  - congenital cochlear anomalies
  - ototoxicity, Meniere's disease, sudden sensorineural hearing loss,
  - hearing loss secondary to auto immune disorders and hearing loss secondary to systemic diseases
  - Noise induced hearing loss and Acoustic trauma, Hearing conservation - national and international guidelines

### **Unit 3: Disorders of Auditory Nerve and Brainstem**

- a) Aetiology, pathophysiology, audiological and non audiological profile, assessment methods (audiological & non-audiological) and management of
  - space occupying lesions of auditory nerve and brainstem
  - hidden hearing loss
  - auditory neuropathy spectrum disorder
  - hearing loss due to vascular loop
  - hearing loss due to temporal bone fractures

### **Unit 4: Assessment of Auditory Processing Disorders**

- a) Normal central auditory processes
- b) Prevalence of auditory processing disorders, etiology, comorbid conditions
- c) Theories, models to explain auditory processing, auditory processing disorder
- d) Assessment of auditory processing disorder:
  - behavioral tests and physiological measures
- e) Diagnosis and classification of auditory processing disorders

## **Unit 5: Management of Auditory Processing Disorders**

- a) Signal enhancement
- b) Environment modifications
- c) Direct remediation techniques
- d) Compensatory strategies including metalinguistic, metacognitive strategies
- e) Management of auditory processing disorder: direct remediation techniques, metalinguistic and metacognitive approaches

### **Recommended Reading**

- a) Berlin, C. I., Hood, L. J., & Ricci, A. (2002). Hair Cell Micromechanics and Otoacoustic Emissions. New York: Thomson Learning Inc.
- b) Chasin, M (2009) Hearing Loss in Musicians: Prevention and Management. San Diego: Plural Publishers
- c) Chermak, G. D., & Musiek, F. E. (2013). Handbook of (Central) Auditory Processing Disorders – Comprehensive Intervention. Vol. II. San Diego: Singular Publishing Group
- d) Geffner, D., & Ross-Swain, D. (2013). Auditory Processing Disorders: Assessment, Management, and Treatment. 2nd Edn. San Diego, Plural Publishing Inc.
- e) Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson.
- f) Hood, L.J. (1998). Clinical applications of auditory brainstem response. San Diego: Singular Publishing Group Inc.
- g) Musiek, F. E., & Chermak, G. D. (2014). Handbook of Central Auditory Processing Disorder: Auditory Neuroscience And Diagnosis. 2nd Edn, Vol: 1. San Diego: Plural Publishing Group Inc.
- h) Musiek, F. E., Shinn, J. B., Baran, J. A., & Jones, R. O. (2020). Disorders of the auditory system. Plural Publishing.
- i) Roeser, R. J., Valente, M., & Hosford-Dunn, H. (2007). Audiology: Diagnosis. New York: Thieme Medical Publishers.
- j) Sanbridge, S.A. (2009). Ear Disorders. San Diego: Plural Publishers
- k) Sininger, Y& Starr, A (2001). Auditory Neuropathy: A new perspective in hearing disorders

## Aud 203 M : Advances in the Management of Auditory Disorders

**Hours 60**

**Marks: 100 - Credits: 4**

**Objectives:** At the end of the course, the students will be able to

- a) understand the different amplification / assistive devices and their changing technology
- b) decide on the approach to device selection and optimization
- c) develop need-based programs and intervention strategies for persons with different types of hearing impairment across age groups,
- d) to list specific needs and know psychosocial and communicative demands and strategies to solve these.
- e) Advice and counsel the needy on strategies for optimal utilization of devices

### **Unit 1: Advances in Hearing Aid and Hearing Assistive Technology**

- a) Application of recent advances in hearing aids and hearing assistive technology : Compression and expansion, microphone directionality, advanced signal processing techniques including noise reduction algorithms, wireless assistive technology, application of nanotechnology in hearing aids,
- b) Techniques to control acoustic feedback, distortion, circuit noise: Electromagnetic interference – measurement, solutions; techniques to improve compatibility of hearing aids with mobile phones
- c) Application of LASER technology in earmold production, earmold modifications for enhancing listening comfort and occlusion reduction– physical and acoustic modifications
- d) Variables affecting electroacoustic measurements and its implications
- e) International and Indian standards/legislations for hearing aids and ALDs.

### **Unit 2: Selection and Fitting of Hearing Aid and Hearing Assistive Devices**

- a) Selection, verification and validation of hearing aids and hearing assistive devices
  - Behavioral measures, speech in noise tests
  - Objective measures- real ear insertion gain measures
  - Physiological measures- acoustic reflexes, cortical evoked auditory evoked potentials
- b) Hearing aid programming, optimization, verification and validation, fine tuning
- c) Special consideration for fitting hearing aids for persons with different types of hearing loss (Sudden hearing loss, unilateral hearing loss, High frequency hearing loss, Cochlear dead region, auditory neuropathy spectrum disorder)
- d) Current trends in hearing aids and hearing aid fitting

### **Unit 3: Speech Perception Through Hearing Aids**

- a) Factors affecting speech perception through hearing aids and hearing devices: Auditory plasticity
- b) Methods to improve speech perception through hearing aids and hearing devices: Speech cue enhancement – spectral shape, duration, intensity, enhancement of CVR, speech simplification, re-synthesis, enhancement of perception of telephone speech

- c) Emerging technology for better speech perception
- d) Effect of noise reduction algorithms and advanced hearing aid technology on speech perception

#### **Unit 4: Rehabilitation of Individuals with Hearing Impairment**

- a) Overview of counselling theories/techniques
- b) Counseling of users of hearing aid and hearing assistive devices: techniques: Realistic expectations, adjusting to hearing device, other management options
- c) Counselling caretaker/significant other of hearing device users
- d) Care, maintenance and troubleshooting of hearing aid and hearing assistive devices
- e) Quality of life of persons with hearing impairment and its enhancement
- f) Measuring Outcomes of different management strategies

#### **Unit 5: Management of the Tinnitus and Hypersensitivity of Hearing**

- a) Characteristics, assessment of tinnitus,
- b) Patho-physiological and neurophysiological models to explain tinnitus and management of tinnitus
- c) Overview to non-audiological management techniques for tinnitus
- d) Audiological management techniques for those with normal hearing and different degrees of hearing loss (TRT, counseling, others) and their outcomes
- e) Models to explain hypersensitivity of hearing (Hyperacusis, misophonia, phonophobia)
- f) Audiological management of persons with hypersensitivity of hearing
- g) Overview to non-audiological management techniques for management of persons with hypersensitivity of hearing

#### **Recommended Reading**

- a) Atcherson, S. R., Franklin, C. A., & Smith-Olinde, L. (2015). Hearing assistive and access technology. San Diego: Plural Publishing Inc.
- b) Baguley, D. M., & Anderson, G. (2007). Hyperacusis: Mechanisms, Diagnosis and Therapies. San Diego: Plural Publishing Inc.
- c) Dillon, H. (2012). Hearing Aids. 2nd Edn. Australia: Boomerang Press.
- d) Hull, R. H. (2014). Introduction to aural rehabilitation. 2nd Edn. San Diego: Plural publishing Inc.
- e) Jastreboff, P.J., & Hazell, J.W.P. (2004). Tinnitus retraining therapy-implementing the Neurophysiological model. United Kingdom: Cambridge University Press.
- f) Mueller, H. G., Rickettes, T. A., & Bentler, R. (2014). Modern hearing aids: Pre-fitting Testing and selection considerations. San Diego: Plural Publishing Inc.
- g) Taylor, B and Muller, G (2021). Fitting and Dispensing Hearing aids (3rd ed), Plural Publishing
- h) Tye-Murray, N. (2015). Foundations of aural rehabilitation - Children, Adults & Their Family Members. 4th Edn. United States of America: Stamford, Cengage Learning.
- i) Tyler, R and Perreau (2022). Tinnitus Treatment - Clinical Protocols Thieme Publishing
- j) Wong, L., & Hickson, L. (2012). Evidence-based practice in audiology: Evaluating interventions for children and adults with hearing impairment. San Diego: Plural Publishing Inc.

## Aud 204 MC : Advances in Paediatric Audiology

**Hours 30**

**Marks 50 : Credits 2**

**Objectives:** After completing this course, the student will be able to

- a) design protocols and recommend guidelines for hearing screening in pediatric population
- b) select appropriate tests/protocols to diagnose hearing loss in children
- c) employ appropriate strategies to manage hearing loss in children
- d) advice the parents on the different communication options available for young children with hearing impairment
- e) identify factors that affect acoustic accessibility and strategies to manage them at home and in classroom and address them, and
- f) to assess hearing and manage hearing loss in children with multiple disabilities.

### **Unit 1: Paediatric Hearing Assessment**

- a) National and international guidelines for screening hearing of neonates, infants and school children, challenges,
- b) Screening for central auditory processing disorders in school children
- a) Choosing appropriate test battery for assessing hearing of children- value added tests, factors to be considered
- b) Differentiating auditory maturation delay, auditory neuropathy spectrum disorder and cochlear hearing loss
- c) Choosing appropriate tests for assessing speech perception of children – factors to be considered
- d) Issues related to assessment and diagnosis of hearing loss in children
- e) Counseling parents/caregivers regarding hearing impairment, sequel and management of children with unilateral hearing loss and mild hearing loss

### **Unit 2: Management of Hearing Loss in Children**

- a) Fitting appropriate listening devices (hearing aids and cochlear implants) and optimizing hearing potential through these devices
- b) Choosing appropriate communication option and parent support counseling
- c) Overview of listening and spoken language approach, auditory training design principles and manual approach
- d) Measuring auditory and spoken language outcomes, identifying red flags
- e) Intervention at school age: Functional hearing assessment, communication assessment, management of auditory processing disorders
- f) Adapting auditory verbal strategies for late identified children and providing group listening training activities for children having different listening skills
- g) Creating optimum listening and learning environment at home and school environment
- h) Role of educational audiologists in management of school going children

### **Unit 3: Assessment and Management of Hearing Loss in Children with Additional Needs**

- a) Assessment of children with multiple disabilities: choosing appropriate test battery, modifications needed while assessing and interpreting results of behavioral and electrophysiological tests while assessing hearing of children with visual problems; cognitive problems; neuro-motor problems
- b) Management of children with multiple disabilities: hearing aid fitting considerations, strategies used and the outcome with different strategies for children with hearing impairment with visual problems; cognitive problems; neuro-motor problems

### **Recommended Reading**

- a) Bess, F.H. & Gravel, J.S. (2006). Foundations of Pediatric Audiology. San Diego: Plural Publishing Inc
- b) Cole, E.B., & Carol, F. (2007). Children with hearing loss- Developing Listening & Talking. United States of America: Plural Publishing Inc.
- c) Driscoll, C. & McPherson, B (2010). Newborn Screening Systems: The complete perspective. San Diego: Plural Publishing Inc
- d) Flexer C A (2008). Pediatric Audiology: Diagnosis, Technology, and Management. New York: Thieme Medical Publishers.
- e) Jack, Katz., Marshall, Chasin., Kristina, English., Linda, J., Hood., Kim, L., Tillery. (2014). Handbook of clinical audiology:
- f) Jane, R., Madell., Carol, Flexer. (2019). Pediatric Audiology: Diagnosis, Technology, and Management.
- g) Martini, A, et al.(1996) Genetics and Hearing impairment, London: Whurr Publishers.
- h) McCreery, R.W. & Walker, E.A. (2017). Pediatric Amplification: Enhancing Auditory Access. San Diego: Plural Publishing Inc
- i) Northern, J. L. & Downs, M. P. (2014). Hearing in Children. San Diego: Plural Publishing Inc
- j) Shprintzen, R.J. (1997). Genetic, Syndromes and communication disorders. San Diego: Singular Publishing Group Inc.
- k) Thorpe, A.M. & Seewald, R (2016). Comprehensive Handbook of Pediatric Audiology. San Diego: Plural Publishing Inc

## Aud 205 MC : Geriatric Audiology

**Hours 30**

**Marks 50 : Credits 2**

**Objectives:** After completing this course, the student will be able to

- a) identify and explain age related changes in the peripheral and central auditory system
- b) modify assessment protocols and interpretation of results depending on the age of the client
- c) recommend hearing devices depending on the age of the client, and
- d) plan rehabilitative strategies considering the age of the client.

### **Unit 1: Aging Auditory System**

- a) Biology of aging: differentiating between hearing loss due to normal aging and hearing loss due to disease/disorder
- b) Factors that affect communication in older adults
- c) Effect of advancing age on the peripheral and central auditory system
- d) Factors that can contribute to hearing loss in older adults
- e) Effect of cognitive decline and other associated problems on speech understanding
- f) Association between cognition and hearing abilities in older adults
- g) Effect of hearing loss on quality of life of older adults

### **Unit 2: Assessment of Hearing of Older Adults**

- a) Behavioral assessment hearing in older adults: factors to be considered during assessment and interpretation
- b) Effect of advancing age on electrophysiological measures of hearing
- c) Assessing central auditory processing in older adults

### **Unit 3: Rehabilitation of Older Adults**

- a) Fitting hearing devices (hearing aids, assistive listening device, cochlear implants) to older adults
- b) Evaluating the efficacy of hearing devices in older adults
- c) Counseling older adults and their significant others regarding use, care and maintenance of hearing devices
- d) listening training for older adults
- e) training for speech reading and communication strategies for older adults:

### **Recommended Reading**

- a) Gordon-Salant, S., Frisina, R.D., Fay, R.R (2010). The aging auditory system. Springer New York.
- b) Jack, Katz., Marshall, Chasin., Kristina, English., Linda, J., Hood., Kim, L., Tillery. (2014). Handbook of clinical audiology: Seventh edition.
- c) Kauffman, T. L., Scott, R. W., Barr, J. O., & Moran, M. L. (Eds.). (2014). A comprehensive guide to geriatric rehabilitation. Elsevier Health Sciences.
- d) Manchaiah, V., & Danermark, B. (Eds.). (2016). The experience of hearing loss: journey through aural rehabilitation. Taylor & Francis.

- e) Montano, J. J., & Spitzer, J. B. (Eds.). (2020). Adult audiologic rehabilitation. Plural Publishing.
- f) Weinstein, B.E. (2000). Geriatric Audiology. Theime. Newyork



## **Aud 206 MO : Minor Optional - 2**

**Hours 15**

**Marks 50 : Credits 1**

- a) Each participating institution can offer any of the following as minor optional. However, a course once offered shall not be repeated for the same batch.
- b) The institution itself can draw the syllabus for the course.
- Auditory Processing Disorders
  - Entrepreneurship
  - Genetics of Speech-language
  - Oncology & Speech Swallow Disorders
  - Speech Production and Analysis
  - Teaching Learning in Audiology
  - Bioethics
  - Event Related Potentials
  - Learning Disability
  - Pharmacology
  - Speech Science

## Aud 207 M : Clinicals in Audiology

**Hours 180+**

**Marks 100 : Credits 6**

### **General Considerations:**

- a) The student should be able to carry out complete audiological evaluation and management of persons with hearing impairment.
- b) After completion of clinical postings, the student will have the ability to apply, show (in a clinical diary/log book), and perform the following on patients/clients:

### **Knowhow**

- a) Recognize the counseling needs of individuals with hearing impairment based on their narratives and responses to questionnaires and validation measures.
- b) Conduct sound field testing while fitting bone anchored and other implantable devices.
- c) Perform real-ear measurements to establish audibility and comfort.
- d) Verify the benefit of compression, directionality, and noise reduction algorithm performance

### **Demonstrate**

- a) Carry out earmold modifications
- b) Perform visible speech mapping
- c) Demonstrate the client and/or parents regarding the daily use, care and maintenance of hearing devices and hearing assistive technology systems.
- d) Perform RECD and REDD
- e) Select assistive listening devices for clients with hearing loss
- f) Diagnose and plan management for persons with auditory processing disorder
- g) Differentially diagnose different auditory disorders

### **Do**

- a) Record ABR for hearing threshold estimation for clicks and 500Hz tone bursts (20 cases)
- b) Estimate hearing thresholds using ASSR (5 cases)
- c) Record ABR for site of lesion testing (10 cases)
- d) Complete audiological evaluation on 25 persons with hearing loss and prepare a detailed report with appropriate recommendations
- e) Select and fit appropriate hearing devices to individuals with different degree, configuration and type of hearing loss (25 cases).
- f) Plan and carry out appropriate aural rehabilitation program for children (10 cases).
- g) Perform electroacoustic measurement of different types of hearing aids and interpret the findings (5 hearing aids).
- h) Evaluate and counsel/carry out appropriate audiological management for 5 persons with tinnitus.
- i) Record aided ALLRs (2 cases).
- j) Carryout assessment of auditory processing disorder for at least 2 persons

## **Evaluation**

- a) Internal evaluation shall be based on attendance, clinical diary, log book and learning conference.  
External evaluation: Involving clinical population, Spot test, OSCE, Record, Viva-voce

## Semester 3

### Aud 301 M : Implantable Auditory Devices

Hours 60

Marks 100 : Credits 4

**Objectives:** At the end of the course, the student should be able to

- a) identify and describe the types of implantable hearing devices,
- b) describe the purpose of different components of any implantable hearing devices,
- c) determine candidacy for implantable hearing devices,
- d) assess benefits from implantable hearing devices and guide the clinical population,
- e) work in a multidisciplinary team and advise the other members of the team
- f) advise and counsel the parents / caregivers of the clinical population, and
- g) understand and contribute to formulation Government policies and schemes relating to implantable hearing devices

#### Unit 1: Development of Technology, Criteria/ Candidacy and Program

- a) Candidacy for bone conduction implantable devices (BCID), middle ear implants (MEI), cochlear implant (CI), auditory brainstem implant (ABI) and mid brain implant (MBI): evidence from research
- b) Comprehensive Candidacy Assessment for implantable hearing devices (IHD- Audiological and non-audiological).
- c) Safety standards and regulation for IHD.
- d) State and central Government schemes for cochlear implants and other implantable devices.
- e) Pre-requisite to start an IHD program
- f) Comprehensive policy issues relating to IHD

#### Unit 2: Bone Conduction Implantable Devices and Middle Ear Implants

- a) Types of BCID and components (per-cutaneous, trans-cutaneous and intra-oral)
- b) Types of MEI and components
- c) Intra-operative and post-operative measurements/assessment for device function (troubleshooting) and performance outcomes
- d) Programming BCID and MEI
- e) Contra indications and management of device failures and poor performance.
- f) Limitations and future development/requirement

#### Unit 3: Cochlear Implants

- a) Concepts and types of CI: external components (sound processor- body worn, BTE, off the ear); internal component (electrode type/design, MRI compatibility & reliability); totally implantable cochlear implants.
- b) Expanding criteria- audiological and non-audiological assessment: single sided deafness, ski sloping SN hearing loss, bilateral asymmetric HL; cochlea/nerve anomaly (classification), auditory neuropathy spectrum disorder (ANSD) and multiple disabilities.

- c) Speech/Sound Coding Strategies: Within and across devices; Evidences from research and critical analysis of each strategy; Features for Enhancing Speech and Music perception.
- d) Surgical procedures: posterior tympanotomy, veria technique, hearing preservation technique; surgical complications and management
- e) Intra-operative measurement: device function (impedance/ voltage/ compliance telemetry); patient function (eCAP, eSRT, eABR and facial nerve monitoring); Special consideration in anomalous cochlear/nerve, ANSD and multiple disabilities.

#### **Unit 4: Programming Cochlear Implants**

- a) Psychophysics of programming: parameters (pulse width, rate of stimulation, frequency allocation/ re-allocation, map law);pre-requisites for mapping: pre-implant radiological report, post-implant radiological report; discharge report of surgeon; non-physiological objective measures (electrode impedance, compliance, electrode voltage); special considerations in cochlea/nerve anomaly, ANSD, multiple disabilities and SSD; Effect of map parameters on perception of loudness, pitch perception, gap,
- b) Programming technique: evidences from research: behavioral maps; objective maps (eCAP, eSRT & eABR based programming); evidence and target based programming (artificial intelligence); self-programming.
- c) Measuring performance and MAP optimization: assessment of benefit: speech and non-speech; electrophysiological measures (EABR and other evoked potentials); optimization of: hearing aid in the contralateral ear for bimodal implants; bilateral cochlear implants; electroacoustic stimulation and SSD.
- d) Complications: identifying and managing device failures; identifying and managing infection, magnet migration, electrode extrusion; identifying and managing poor performance; decision making in subjects with poor performance; special consideration in revision implantation; outcome audit.
- e) Limitations and future developments/requirements (device, techniques and procedures)

#### **Unit 5: Auditory Brainstem Implant (ABI) and Auditory Midbrain Implant (MBI)**

- a) Pre-op (ABI and MBI): candidacy for children and adult; audiological and non-audiological assessment; evidences from research for predicting outcome; counseling and expectations; device type and components
- b) Intra-op (ABI and MBI): Surgical procedures – overview; eABR, cranial nerve monitoring; decision-making.
- c) Post-op: programming ABI (subjective and objective methods) and technique for pitch ranking, identifying auditory and non-auditory electrodes); MAP optimization (pitch, loudness, auditory and non-auditory sensation); techniques to identify auditory and non-auditory sensation; assessment of benefit: speech and non-speech; role of eABR, aided cortical potentials, PET and fNIRS in programming and monitoring outcomes.
- d) Managing and monitoring persons with ABI: rehabilitation strategy; identifying and managing complications (device failure, infection, trauma, device migration, radio imaging); identify poor performance- auditing outcome; decision making in complications and poor performance

## Recommended Reading

- a) Boheim, K. (2010). Active middle ear implants. Basel: Karger.
- b) Clark, G., (2003). Cochlear implants - fundamentals & Applications. New York: Springer – AIP Press.
- c) Eisenberg, L. S. (Ed.). (2016). Clinical management of children with cochlear implants. Plural Publishing.
- d) Gifford, R. H. (2020). Cochlear implant patient assessment: Evaluation of candidacy, performance, and outcomes. Plural Publishing.
- e) Hughes, M. L. (2013). Objective measures in cochlear implants. San Diego: Plural Publishing Inc.
- f) Kirwin, S.H. (2014). Cochlear Implants: Technological advances, psychological/social impacts and long-term effectiveness. New York: Nova Biomedical.
- g) Kompis, M., & Caversaccio, M.D. (Eds.). (2011). Implantable Bone Conduction Hearing Aids. (New Delhi) Switzerland: Karger.
- h) Lim, H. H., Lenarz, M., & Lenarz, T., (2009). Auditory midbrain implant: A review. Trends in Amplification, Sept. 13(3), 149–180.
- i) Manenkar, G. (2014). Implantable hearing devices other than cochlear implants. New D Suzuki, J.I, Tokyo (1988). Advances in audiology-Middle ear implant: Implantable hearing aids. Switzerland: Karger. Delhi: Springer-Verlag.
- j) Niparko, J. K. (2009). Cochlear Implants: Principles and practices. 2nd Edn. Philadelphia: Lippincott: Williams & Wilkins.
- k) Ruckenstein, M. J. (Ed.). (2020). Cochlear implants and other implantable hearing devices. Plural Publishing.
- l) Sevier, J. D. (2022). Complex Cochlear Implant Cases: Management and Troubleshooting. Plural Publishing.
- m) Wolfe, J. (2018). Cochlear implants: audiologic management and considerations for implantable hearing devices. Plural Publishing.
- n) Wolfe, J., & Schafer, E. C. (2010). Programming Cochlear Implants. San Diego: Plural Publishing Inc.

## Aud 302 Vestibular System and its Disorders

**Hours 75 (45 + 30)**

**Marks 100 : Credits 4**

**Objectives:** After passing this course, the student should be able to

- a) describe the anatomy and physiology of the human vestibular system
- b) perform tests for vestibular assessment and interpret the results
- c) identify vestibular pathologies and differentially diagnose between them
- d) Carryout vestibular rehabilitation and make appropriate referrals
- e) Counsel the affected and their family members

### **Unit 1: Anatomy and Physiology of the Systems of Balance**

- a) Anatomy and physiology of peripheral vestibular system (semicircular canals, Utricle, Saccule, Vestibular nerve)
- b) Anatomy of the central vestibular pathway and its connections
- c) Reflexes involving the vestibular system (Vestibuloocular, Vestibulospinal reflex and Sacculocollic reflex)
- d) Proprioceptive (somatosensory) system and visual system
- e) Association between vestibular system and cognition

### **Unit 2: Disorders of the Vestibular System**

- a) Diseases of the vestibular labyrinth (Meniere's disease, and Benign paroxysmal positional vertigo, among others)
- b) Diseases of the nerve (Vestibular neuritis, Auditory neuropathy spectrum disorders, Vestibular schwannomas, Vestibular Paroxysmia)
- c) Diseases of the central nervous system (Generalized neuropathy involving multiple systems, Multiple sclerosis, Tumors of CP angle, among others)
- d) Pathologies affecting entire balance pathway (Presbystasis, Diabetes Mellitus and others systemic diseases)
- e) Vestibular disorders in childrens

### **Unit 3: Assessment of Vestibular System**

- a) Questionnaire based assessments
  - Questionnaires for screening and diagnosis (Standard case history, Vertigo symptom scale, Motion sensitivity quotient)
  - Questionnaires for quality of life assessment (Dizziness handicap inventory, Activities-specific balance confidence scale, Vestibular disorders activities of daily living, visual analog scales)
- b) Behavioral tests for bedside assessment, and diagnosis- background, technique involved, interpretation and usefulness (Romberg test and others)
- c) Physiological/electrophysiological tests- background, technique involved, interpretation and usefulness (Rotatory chair test, Positional/positioning tests and others)

#### **Unit 4: Non-medical Management of Vestibular Disorders**

- a) Treatment of BPPV of Posterior Canal (Epley manoeuvre, Semont liberatory manoeuvre, Gans repositioning manoeuvre)
- b) Treatment of BPPV of lateral semicircular canal (Barbeque roll manoeuvre, Appiani maneuver, Guffoni liberatory manoeuvre, Zuma Manoeuvre)
- c) Treatment of BPPV of Anterior semicircular canal- Yacovino Manoeuvre
- d) Habituation exercises for recurrent BPPV (Brandt-Daroff exercises)
- e) Treatment for heavy and light cupula
- f) Concept of central compensation and decompensation in vestibular disorders
- g) Vestibular rehabilitation therapy: Principle, Candidacy, procedure and efficacy
- h) Rehabilitation of children with disequilibrium

#### **Unit 5: Medical Management of Vestibular Dysfunction**

- a) Role of radiological evaluations and other lab tests (in the diagnosis and management of vestibular disorders: purpose, findings and implication)
- b) Lab investigations: purpose, findings and implications (Blood investigations, Urine and Others like ECG, Vitamin profiles, etc.)
- c) Dietary modifications: candidacy, effectiveness and contraindication
- d) Vestibular suppressants: candidacy, use, effectiveness and contraindication
- e) Surgeries for vestibular disorders: types, candidacy, procedure, effectiveness and contraindications
- f) Other forms of medical management for specific disorders
  - Intratympanic Gentamycin: candidacy, effectiveness and contraindication
  - Steroid Therapy: candidacy, effectiveness and contraindication

#### **Recommended Reading**

- a) Ackley, R. S., Decker, T. N., & Limb, C. J. (2007). An essential guide to hearing and balance disorders. New Jersey: Lawrence Erlbaum Associates Inc. Publishers.
- b) Desmond, A. L. (2004). Vestibular function: evaluation and treatment. New York: Thieme Medical Publishers Inc.
- c) Dispenza, F., & De Stefano, A. (2013). Textbook of vertigo: diagnosis and management. JP Medical Ltd.
- d) Jacobson, G. P., & Shepard, N. T. (2008). Balance function assessment and management. San Diego: CA: Plural Publishing Inc.
- e) Kaga, K. (2014). Vertigo and balance disorders in children. Japan: Springer.
- f) Martines, F., & Salvago, P. (2021). Dizziness: Prevalence, Risk Factors, and Management. Philadelphia, USA: Nova Science Publishers Inc.
- g) McCaslin, D. L. (2019). Electronystagmography and Videonystagmography (Eng/Vng). San Diego, CA: Plural Publishing, Inc.
- h) O'Reilly, R. C., Morlet, T., Cushing, S. L., & Brodsky, J. R. (2019). Manual of ediatric balance disorders. Plural Publishing.
- i) Singh, N.K., & Vanaja, C.S. (2018). Evaluation and Management of Vestibular Dysfunction. ISHA Monograph.



## Aud 303 MC : Genetics of Hearing

**Hours 30**

**Marks 50 : Credit 2**

**Objectives :** After completing this course, the student will be able to

- a) understand the genetic basis of hearing loss
- b) explain the importance of genetic testing in the diagnosis and management of hearing disorders.
- c) refer clients for genetic testing
- d) counsel parents or caregivers of children with genetic hearing loss

### **Unit 1: Molecular Genetics for Audiologists**

- a) Basic concepts of genetics
- b) Genetic inheritance: Mendelian, Non Mendelian, multifactorial
- c) Genetic mutations, copy number variations (CNVs) and single nucleotide polymorphisms (SNPs)
- d) Overview of Genetic testing (cytogenetic, biochemical genetics, molecular genetics), Gene mapping and localization
- e) Molecular basis of hearing, genes involved in auditory development and hearing

### **Unit 2: Genetics and Hearing Loss**

- a) Genetics of hearing impairment, gene database for hearing loss
- b) Congenital hearing loss due to genetic disorder-syndromic and non-syndromic
  - Genes identified, genotype, Phenotype
- c) Late onset hearing loss due to genetic disorder
  - Genes identified, genotype, Phenotype
- d) Genetic heterogeneity of hearing disorders

### **Unit 3: Evaluation and Management of Genetic Hearing Loss**

- a) Screening genetic hearing loss
- b) Genetic evaluation of persons/families with hearing loss,
- c) Benefits and limitation of genetic testing, client selection for genetic testing, Ethical considerations during genetic testing
- d) Counseling clients/parents regarding genetic hearing loss
- e) Gene therapy for hearing disorders

### **Recommended Reading**

- a) Cremers, C. W. R. J., & Smith, R. (Eds.). (2002). Genetic hearing impairment: its clinical presentations (Vol. 61). Karger Medical and Scientific Publishers.
- b) Jones, S. M., & Jones, T. A. (2011). Genetics, Embryology, and Development of Auditory and Vestibular Systems. Plural Publishing.
- c) Robin, N. H. (2008). Medical genetics: its application to speech, hearing, and craniofacial disorders. Plural Publishing.

- d) Shprintzen, R.J. (1997). Genetic, Syndromes and communication disorders. San Diego: Singular Publishing Group Inc.
- e) Toriello H V.,& Smith S D. (2013).Hereditary Hearing Loss and Its Syndromes. United Kingdom: Oxford University Press.
- f) Willems P J. (2004). Genetic Hearing loss. USA: Marcel Decker Inc.

## Aud 304 M : Clinicals in Audiology

**Hours 180+**

**Marks 100 : Credits 6**

### **General Considerations**

- a) The student should be able to carry out complete audiological evaluation and manage persons with hearing impairment and hearing-related vestibular disorders
- b) After completion of clinical postings, the student will have the ability to apply, show (in a clinical diary/log book), and perform the following on patients/clients

### **Knowhow**

- a) Advise clinical clientele on the latest implantable devices available for persons with hearing impairment.
- b) Set up vestibular assessment and management clinics / centers
- c) Administer canalith repositioning maneuvers to individuals diagnosed with benign paroxysmal positional vertigo (BPPV).

### **Demonstrate**

- a) Administration of subjective balance assessment tests
- b) Administration of objective balance assessment tests including VEMPs, vHIT and VNG
- c) Plan management for 5 persons different types of vestibular disorders
- d) Troubleshoot cochlear implants
- e) Cochlear implant mapping changing the parameters based on the needs of clients
- f) Vestibular rehabilitation therapy for patients with vestibular problems

### **Do**

- a) Administer complete vestibular test battery, behavioral and electrophysiological tests on 10 individuals with vestibular disorder and prepare a report explaining the results of the test and make appropriate recommendations
- b) Carry out pre-implant counseling for 5 persons with hearing loss
- c) Carry out mapping for 5 persons using cochlear implants
- d) Counsel 5 persons regarding use and maintenance of cochlear implants
- e) Plan and carry out therapy for 5 children with hearing loss (minimum of 10 sessions each)

### **Evaluation**

- a) Internal evaluation shall be based on attendance, clinical diary, log book and learning conference.
- b) External evaluation: Spot test, OSCE, Record, Viva-voce, case work

## Semester 4

### Aud 401 M : Speech Perception

Hours 60

Marks 100 : Credits 4

**Objectives:** At the end of the course, the student will be able to

- a) explain coding of speech in the auditory pathway in normal hearing and hearing impaired individuals,
- b) critically evaluate theories of speech perception and methods of synthesis of speech,
- c) explain speech perception in relation to short term memory, and
- d) describe aspects of dichotic speech perception and the bases of this.

#### Unit 1: Theories of Speech Perception

- a) Basic concepts of speech perception; hearing, listening, perception and comprehension; acoustic cues of different classes of speech sounds
- b) Definition and concept of categorical and continuous speech perception
- b) Normalization in speech perception: Definition and methods used for normalization of vowels and consonants
- c) Coding of speech in the auditory pathway - cochlea, auditory nerve and the central auditory pathway
- d) Theories of speech perception (acoustic, neurological, auditory, motor, analysis-by-synthesis, dual stream, reverse hierarchy theory)

#### Unit 2: Perceptual Cues for Vowels and Consonants

- a) Perception of vowels, diphthongs and consonants in persons with normal hearing- major and minor cues to identify place, manner and voicing features of stops, fricatives, affricates, nasals
- b) Perception of vowels and consonants in the persons with hearing impairment
- c) Perception of vowels and consonants through amplification.
- d) Perception of vowels and consonants through implantable devices

#### Unit 3: Speech Perception of Segmental and Suprasegmental Features

- a) Effects of co-articulation on speech perception:
- b) Perception of segmental features in normal hearing individuals
- c) Perception of suprasegmental cues in normal hearing individuals
- d) Perception of segmental and suprasegmental cues in persons with hearing impairment

#### Unit 4: Factors Related to Speech Perception

- a) Memory and speech perception: Stages of memory, coding and capacity at the different stages; Models of short term memory: Dual coding Model, Modal model, A model for auditory memory and contrast, Working memory model; Role of short term memory in the perception of consonants and vowels
- b) Dichotic listening: Theories and physiological bases: Testing of dichotic listening and the clinical significance of the results; Factors influencing dichotic perception

- c) Music perception: Methods of study of perception of music; Perception of music through amplification and implantable devices.

### **Unit 5: General Issues Related to Speech Perception**

- a) Infant perception: theories of infant speech perception (universal theory, attunement theory, perceptual learning theory, maturational theory, perceptual magnetic theory); methods of studying infant speech perception; perception of consonants and vowels in infants, and comparison with adults
- b) Speech perception in animals: methods of study of speech perception in animals; perception of consonants and vowels; categorical perception and normalization; animal vs. human perception; need for study of speech perception in animals
- c) Methods to study speech perception: EEG/electrophysiological and behavioral methods to study speech perception; study designs; role of cognition in speech perception.

### **Recommended Reading**

- a) Greenberg, S., Ainsworth, W. A., & Fay, R. R. (Eds.).(2004). Speech Processing in the Auditory System. New York: Springer.
- b) Holt, L. L., Peelle, J. E., Coffin, A. B., Popper, A. N., & Fay, R. R. (Eds.). (2022). Speech perception. Springer.
- c) Martin, P. (2020). Speech acoustic analysis. (1st edition). Wiley-ISTE.
- d) Pardo, J.S., Nygaard, L.C., Remez, R.E., & Pisoni, D. B. (Eds.). (2021). The Handbook of Speech Perception. (2nd edition). Blackwell Publishing Ltd.
- e) Raphael, L. J., Borden, G. J., & Harris, K. S. (2011). Speech science primer: Physiology, acoustics, and perception of speech. (6th edition). Lippincott Williams & Wilkins.
- f) Richter, M. M., Paul, S., Kepuska, V., & Silaghi, M. (2022). Signal processing and machine learning with applications. Springer.
- g) Seki, Y. (Ed.). (2023). Acoustic Communication in Animals: From Insect Wingbeats to Human Music (Bioacoustics Series Vol. 1). Springer Nature.
- h) Tatham, M., & Morton, K. (2011). A Guide to Speech Production and Perception (1 edition). Edinburgh: Edinburgh University Press
- i) Uhrig, S. (2021). Human information processing in speech quality assessment. Springer.

## **Aud 402 M : Dissertation**

**Hours 300+**

**Marks 100 : Credits 10**

Though dissertation, a report on the results of an experimental research, is shown only Semester 4, students are free to initiate the work in Semester 3 itself utilizing the free time.

## Aud 403 M : Clinicals in Audiology

**Hours 180+**

**Marks 100 : Credits 6**

### **General Considerations**

- a) The student should be able to carry out complete audiological evaluation and manage persons with hearing impairment.
- b) After completion of clinical postings, the student will have the ability to apply, show (in a clinical diary/log book), and perform the following on patients/clients.

### **Knowhow**

- a) Set up audio-vestibular assessment and management clinics or centers in different set-ups
- b) Procedure for certification of persons with disability
- c) Financial planning and insurance policies

### **Demonstrate**

- a) Administration of complete audiological test battery
- b) Plan management for 10 persons with different types of audio-vestibular disorders (should include tinnitus and vestibular disorders)

### **Do**

- a) Administer complete audio-vestibular test battery, behavioral and electrophysiological tests on 20 individuals (should include presbycusis, NIHL, ANSD, BPPV) and prepare a report explaining the results of the test and make appropriate recommendations
- b) Administer complete cochlear implant candidacy assessment, pre-implant counseling, switch-on, mapping AVT (for at least 3 months) on 5 children with hearing impairment
- c) Administer tinnitus assessment and treatment on 5 individuals with tinnitus

### **Evaluation**

- a) Internal evaluation shall be based on attendance, clinical diary, log book and learning conference.
- b) External evaluation: Involving clinical population, Spot test, OSCE, Record, Viva-voce

**Infrastructure Requirements for M.Sc (Aud) Program  
(Academic year 2024-25 onwards)**

The following are the minimum requirements for starting/continuing a 12 student-intake M.Sc (Aud) program. This requirement is over and above the stipulated infrastructure (faculty, clinical staff) for other speech and hearing program in a given institute unless otherwise stated.

This statement on infrastructural requirement shall override all other statements/documents/guidelines on the topic issued by the Council.

**Human Resource Requirement**

Requirement of scientific / technical / administrative staff for the M.Sc (Aud) program with an intake of 12 students per year shall be as follows (see the notes below the table):

Type	Designation	No.
Core Faculty	Professor - Audiology	1
	Associate Professor - Audiology	1
	Assistant Professors - Audiology	2
Clinical Staff	Audiologist - Gr. I	1
Allied Faculty	Asst. Prof in Statistics	1
Allied Clinical staff	Clinical Psychologist	1
	Oto-laryngologist	1
	Neurologist	1
Supporting staff – Tech	Electronics Engineer	1
	Bio-medical / Computer technician	1
	Library & Information Officer	1
	Library Assistant	1
Supporting staff - Admin.	Administrative Secretary - Academics	1
	Secretary - Clinic	1
	Secretary - Admin	1

Note 1: Core faculty to student ratio should always be 1:3 (one faculty member for every 3 students). The number of core faculty shall be the basis for determining intake. However, the intake for M.Sc programs shall not exceed 15 ideally.

Note 2: Allied faculty, allied clinical staff, supporting staff – tech and supporting staff - admin can be part time functionaries, can be shared with other programs at the institute, and their appointment can be guided by the requirements in a given semester.

Note 3: The M.Sc. (Aud) program can only be conducted by an independent institute/ college/ department in a University / department in a hospital / rehabilitation unit, with a full-time audiologist, or audiologist & speech-language pathologist as its head/ coordinator (administrative / academic / clinical). The head of the program should possess a doctorate in the core area.



Note 4: Core areas refer to Audiology

### Professional qualification of core faculty and clinical staff

Designation	Qualifications
Professor	<p><b>Essential</b></p> <p>a) M.Sc (Aud), M.Sc (Sp &amp; Hg) / or M.ASLP) or its equivalent</p> <p>b) PhD (in the core area*)</p> <p>c) 10 years teaching experience at PG/UG level</p> <p>d) Minimum of five publications with cumulative impact factor of 05.</p> <p>e) Valid RCI registration</p> <p><b>Desirable</b></p> <p>Experience of running under-graduate training programs</p>
Associate Professor	<p><b>Essential</b></p> <p>a) M.Sc (Aud) / M.Sc (Sp &amp; Hg) / M.ASLP or its equivalent</p> <p>b) 8 years teaching experience at PG/UG level</p> <p>c) Minimum 5 publications with a cumulative impact factor of 4.</p> <p>d) Valid RCI registration</p> <p><b>Desirable:</b></p> <p>a) Ph.D (in the core area*)</p> <p>b) Experience of running under-graduate training programs</p>
Assistant Professor- Audiology	<p><b>Essential</b></p> <p>a) M.Sc (Aud) / M.Sc (Sp &amp; Hg) / M.ASLP or its equivalent</p> <p>b) 2 years teaching/ clinical / research experience</p> <p>c) Valid RCI registration</p> <p><b>Desirable:</b></p> <p>a) Ph.D (in the core area*)</p> <p>b) Publications</p>
Audiologist Grade I	<p><b>Essential</b></p> <p>a) M.Sc (Aud) / M.Sc (Sp &amp; Hg) / M.ASLP or its equivalent</p> <p>b) Valid RCI registration</p> <p><b>Desirable:</b> 1 year experience in the field</p>

Note 1: \*Audiology

Note 2 : Pay and emoluments for all faculty posts shall be on par with UGC norms.  
RCI norms shall apply for all other clinical and technical posts

### Clinical

The institution should have facility for diagnosis, management, and rehabilitation of all types of persons, and of all ages, with hearing and hearing-related disorders.

Size of the clinical population shall be 2 per student per semester in each of the following main clinical areas: persons with hearing disorders, vestibular disorders, CAPD and other hearing-related disorders. This requirement of clinical population shall be over and above that required for other speech and hearing training programs at the institute.

### Library

Library should accommodate at least 30% of the staff and students of the institute at any given time.

Library should have internet and photocopying facilities.

The participating institution shall ensure that at least 25% of books mentioned under the 'Recommended reading' are available. There shall be addition of at least 5 books every year.

Books and journals can be either hard copies or e-versions, but accessible to all.

There should be at least 2 journals at the start of the M.Sc (Aud) program over and above that required for B.ASLP program at the institute. The institution should subscribe to two more journals in the core area every five years.

### Library Staff\*

- a) Library and Information Officer / Library Assistant - 1  
Qualification: B.Lib Sci with one year experience in managing a technical library

\* Library staff can be common for all the courses at a given institute

### Space

Sl.No.	Category	Size	Number (For a batch of 12 students)
a)	Class rooms	Space @ 10 sq. ft per student + 20 Sq. ft for the teacher: Room with a minimum area of 300 sq. ft.	There shall preferably be one classroom for batch of M.Sc (Aud)
b)	Seminar hall	Space to accommodate 50% of total student strength	1 hall for a batch of 12 students
c)	Computer lab/multipurpose hall	Space to accommodate 50% of total student strength	1 computer lab for a batch of 12 students
d)	Room for reception where patients are registered.	10' x 10'	1 room for a batch of 12 students
e)	Room for case history, diagnostic room and interviews	6' x 8'	4 rooms for a batch of 12 students

f)	Audiology Lab	15' x 15'	1
g)	Sound treated room : 2-room situation	16' x 10'	1
h)	Earmold lab	10' x 10'	1
i)	Board Room	15' x 20'	1 room
j)	Individual work space (with provision for storage facilities)	10' x 10'	1 room for every 2 faculty/staff members
k)	Academic/administrative office	10' x 10'	1
l)	Principal's Office room	10' x 10'	1
m)	Sanitary facilities	Separate facility for males and females, staff/students and clinical population	
n)	Hostel	Separate hostel for Men and Women: Accommodation for at least 50% of students	
o)	Barrier free access		
p)	Space for recreation - both indoor and outdoor		

Note: All categories of space mentioned above except classrooms can be common to all other speech and hearing training programs in the institute.

#### Equipment - Audiology (Minimum for a batch of 12 students)

Sl. No	Test/Equipment	Number
a)	Diagnostic/clinical pure tone audiometer	1
b)	Diagnostic immittance audiometer	1
c)	Diagnostic OAE analyzer	1
d)	2-Channel EP System	1
e)	Speech audiometry tests including those for assessment of CAPDs - in different languages	1 set for a batch of 12 students
f)	Hearing Aid Programming Software	1
g)	Mapping device for cochlear implant	1
h)	Diagnostic material/equipment for assessment of hearing related vestibular disorders	1
i)	Real ear measuring equipment and hearing aid analyzer	1
j)	Ear mold laboratory or 3-D printing (by possession or through access)	1
k)	Hi-Fi Ampli Deck with speakers and good microphone	1
l)	Handheld otoscope	1

Note : Equipments and tests listed here except (a) to (d) can be common with other speech and hearing training programs in the institute.

## Suggestive Reading (Indian Authors)

<b>Sr.No</b>	<b>Title</b>	<b>Author</b>	<b>ISBN</b>
1	Research methodology - a brief survey	Kumar, Pradeep	978-9380833378
2	Reserach methodology and statistical tecniques	Gupta, Santosh.	8171005012
3	Research methodology	Manoharan, P K	978-8131305300
4	Research methodology	Singh, Yogesh Kumar.	978-8176489638
5	Research methodology	Jha, Avdhesh S	978-8131310632
6	Research methodology	Bhatt, Dipti P	978-8131310854
7	Research methodology	Singh, S R	978-8131313756
8	Research methodology	Pandya, Shefali.	978-8131316054
9	Research methodology: methods and techniques	Kothari, C R	8122415229