

MASTER OF SCIENCE IN AUDIOLOGY

M.Sc (Audiology)

SEMESTER SCHEME

REGULATIONS, NORMS, SCHEME OF EXAM AND CURRICULUM

REHABILITATION COUNCIL OF INDIA

(Statutory body under Ministry of Social Justice & Empowerment)

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REGULATIONS & NORMS– 2009

MASTER OF SCIENCE IN AUDIOLOGY

M.Sc (Audiology)

1.0 Courses offered and duration of the course

1.1 M.Sc (Audiology)

1.2 Duration of the course: 4 Semesters / 2 years

Note: Each semester shall extend over a minimum period of eighteen weeks excluding examination days.

2.0 Eligibility for admission

2.1 Candidates with a BASLP/B.Sc (Speech and Hearing) degree of any recognized University are eligible for admission to the course.

2.2 There is no upper age limit for admission to the course.

2.3 Admission shall be made on the basis of:

a) Marks obtained in the entrance examination conducted by the Institution/university

b) Marks obtained in the qualifying examination.

OR

As per university norms

2.4 Entrance Examination

2.4.1 The object of entrance examination is to assess the knowledge and skill of the candidates in the core subjects of BASLP.

2.4.2 The Head of the Institution shall appoint a committee of examiners to conduct the entrance examination.

2.4.3 The entrance examination shall be conducted at the Head Quarters of the Institution.

2.4.4 Duration of the entrance examination shall be for 100 minutes with 100 questions of the multiple choice type.

2.4.5 Candidates can appear for the entrance examination in anticipation of results of qualifying examination. However, they have to fulfill the condition of 2.1 and provide records for the same before the stipulated date for admission.

2.4.6 The selection committee shall consist of the Head of the Institution, as Chairperson, one faculty member of the institution nominated by Head of the Institution, and one member nominated by the Vice-Chancellor.

3.0 Scheme of Instruction

- 3.1 In each semester there shall be five papers. The detailed scheme of examination and paper titles are as given in **Annexure – I**.
- 3.2 Dissertation/Clinical practicum shall be in lieu of a paper.
- 3.3 The syllabus of every paper shall as far as possible, be divided in to five units.
- 3.4 Candidates shall attend camps/extension programs/educational tour conducted by the institution.
- 3.5 Hours of instruction (contact hours) per week
Theory : 4 hours per subject per week
Practical : I year – 15 hours per week
 II year – 20 hours per week

4.0 Attendance

- 4.1 Each semester shall be taken, as a unit for purpose of calculating attendance and a Candidate shall be considered to have put in the required attendance for the semester, if he/she has attended not less than 80% in case of theory classes and 90% in clinical practicum during each semester.
- 4.2 Shortage of attendance up to 15% may be condoned by the Vice Chancellor on the recommendation of the Head of the Institution on payment of a fee prescribed by the University. There shall be no condonation if attendance is below 65% in theory classes and 75% in clinical practicum during any semester.
- 4.3 A candidate who is having shortage of attendance in clinical practicum is permitted to make up this shortage by attending clinical work during vacation immediately after that semester but before commencement of the next semester.
Note: The candidates are permitted to avail this facility (4.3) in the I and III semesters only, with prior permission of the Head of the Institution.
- 4.4 A candidate, who fails to satisfy the requirement of attendance in a semester, shall rejoin the same semester in the immediate next academic year.
Note: This facility shall be available only **once** in the entire course.
- 4.5 If a candidate represents his/her Institution in Sports/NSS/Cultural or any official activities, he/she is permitted to avail to a maximum of 30 days in an academic year based on the recommendation and prior permission of the Head of the Institution.

5.0 Medium of Instruction

- 5.1 Medium of instruction shall be English.

6.0 Appearance for the Examination

- 6.1 Candidates on satisfactorily completing a semester shall apply for the examination in all papers prescribed for that semester.

7.0 Scheme of Examination

- 7.1 There shall be a University Examination at the end of each semester.
- 7.2 Duration of examination of theory paper of 80 marks shall be for 3 hours.
- 7.3 In case of theory paper the internal assessment will be for 20 marks, assessed through tests, seminars, camps and other assignments.

7.8 Clinical Practicum

- 7.8.1 The clinical practicum examinations shall be in the main subjects of study, i.e., in Audiology/Speech-Language Pathology (including the components of speech sciences).
- 7.8.2 Clinical practicum is part of all the semesters. However, internal assessment and clinical practicum examination with respect to clinical practicum of I and II semesters shall be conducted at the end of II semester. And that of III and IV semesters shall be conducted at the end of the IV semester.
- 7.8.3 Break up of marks of clinical practicum shall be as follows:
- (a) 50 marks are allotted for internal assessment which is awarded on the basis of continuous evaluation of the clinical work of the candidate by the faculty of the departments to be nominated by the Director. The faculty shall evaluate each candidate on the following bases:
 - i. Clinical skill/repertoire
 - ii. Planning of therapy and execution
 - iii. Maintenance and quality of clinical diary, lessons plans and progress report
 - iv. Rapport with case/family
 - v. Development of teaching aids
 - vi. Efficient use of time/skills in execution
 - vii. Professional attitude/motivation/aptitude for clinical work.
 - (b) 50 marks for clinical viva-voce conducted by an external examiner who shall examine the candidates' clinical skills while working with clinical population. Each candidate shall be assigned one or more subjects for this purpose by the heads of the concerned departments with the approval of the Head of the Institution.
- 7.8.4 Candidates failing/absenting in the clinical practicum examination shall repeat the clinical work of the previous two semesters i.e., candidates failing in clinical practicum of II semester shall repeat I and II semesters with respect to clinical practicum. Such candidates are not permitted to go to III semester. Candidates failing in clinical practicum of IV semester shall repeat III and IV semesters with respect to clinical practicum.

7.9 Dissertation work

- 7.9.1 There shall be 100 marks for dissertation work.

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

8.0 Board of Examiners, Valuation

As per University norms.

9.0 Classification of successful Candidates

9.1 Minimum for a pass in each paper shall be 50% (exam. proper and internal assessment put together) and 50% in aggregate of all the semesters put together. There shall be no separate minima either for exam proper or for internal assessment.

9.2 Minimum for a pass in clinical practicum in each part (a & b of 7.8.3) shall be 50%.

9.3 For declaration of, First class with Distinction / First Class / Second class, the aggregate of the total marks secured by a candidate (including repeaters) in all the semesters shall be considered as detailed below:

70	\leq	P	\leq	100	First Class with Distinction
60	\leq	P	$<$	70	First Class
50	\leq	P	$<$	60	Second Class

Here P is the percentage of total marks secured in all the semesters of that course.

10.0 Provisions for Repeaters

As per University norms.

11.0 Award of Grace marks

As per University norms.

12.0 Norms for Minimum Infrastructural Facilities:

1.	Faculty/Personnel	BASLP (20 seats) (Column 1)	BASLP (20 + 20 seats) (Column 2)	BASLP + MASLP (20 + 10 seats) (Column 3)	BASLP + MASLP/ M.Sc. (Aud.)/M.S c. (SLP) (40 + 15 seats) (Column 4)	M.Sc (Aud.)/M.Sc. (SLP) as addition to BASLP (40 seats) and MASLP (15) with 10 seats for each specialized M.Sc (Column 5)
a.	Full time					
	Professor			1 Professor or 2 Readers	1 Professor or 3 Readers	1 Professor or 1 Reader in each PG specialization in addition to that given in Column 4
	Reader or equivalent	1	1	1	1	1
	Lecturer	3	3 + 1	5	6	+2 in addition to that given in Column 4
	Speech Pathologist/Audiologist (Grade I) (Clinical Supervisor)	1	1 + 2	4	6	+2 in addition to that given in Column 4
	Speech Pathologist/Audiologist (Grade II)	2	2 + 1	2	4	4
	Lecturer in Clinical Psychology – Part time	1	1	1	1	1
	One Medical faculty as per requirement of the paper – Part time	1	1	1	1	1
	Lecturer in Linguistics – part time	1	1	1	1	1
	Electronic Engineer	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
b.	Visiting faculty for Anatomy and Physiology	1	1	1	1	1

NOTE :

1. Minimum of 2 faculty members in core areas will be required for giving recognition for the first year.

2. Before the commencement of second academic year one more lecturer must be appointed.
3. Before the commencement of third academic year one Reader must be appointed.
4. Only on completion of three batches of BASLP, an Institution becomes eligible to increase the intake provided infrastructure is increased as per laid down norms of RCI. Institute will be eligible to apply for starting MASLP course after the 1st batch of BASLP passes out, i.e; after 4 years of starting BASLP course subject to recommendation of Inspection Team/Visiting Expert.
5. In case of Professor not being available, 2 Readers are appointed to accommodate research guidance and administrative work.
6. All reservations in admission will apply as per Govt. rules for aided and Govt. institutions. The infrastructure will have to be enhanced as per the the seats getting increased under reservation policy.

Designation	Qualification		Experience		Publications
	Essential	Desirable	Essential	Desirable	
Professor	Ph.D. (Sp & Hg)		10 years teaching experience in the field		Essential
Reader/ Associate Professor	Ph.D. (Sp & Hg) or M.Sc. (Sp&Hg) with equivalent work by publications and research	Ph.D. (Sp. & Hg)	5 years of teaching / research/ clinical experience with graduate/ post graduate courses		Essential
Lecturer/ Assistant Professor	M.Sc.(Sp& Hg)	Ph.D. (Sp& Hg)	2 years clinical / research experience	Teaching experience	
Speech Pathologist/ Audiologist Grade I	M.Sc. (Sp& Hg)				
Speech Pathologist/ Audiologist Grade II	B.Sc. (Sp& Hg)	M.Sc. (Sp& Hg)			

12.1. Clinical Facilities

Facilities for diagnostic evaluation of speech, language, voice, hearing and associated disorders, both functional and organically based. Clients of all age groups with hearing impairment and clients with speech and language disorders.

Load and variety of clients should be commensurate with number of courses conducted and also to meet the clinical practicum requirement of each year of the course.

12.2. Library Facilities:

Library should accommodate at least, 30% of the institution’s students and staff total strength. Library should have internet and photocopying facilities.

- a) **Reading room :** Two reading rooms should be there
 - (i) Reference room with CBTIV and internet provisions
 - (ii) General Reading room

- b) **No. of books:** Books listed for each paper under “essential” should be available.

- c) **No. of Journals:** There should be atleast 5 most essential journals (2 each in Speech & Audiology and 1 general) for BASLP and 8 at MASLP levels (4 each for Speech & Audiology).

- d) **Staff :**
 - (i) Library and Information Officer – One No.
Qualifications: B.Lib with two years of experience in handling technical library using Information Technology.

 - (ii) Library Assistants: One
Qualifications: SSLC + Diploma in Library Sciences or SSLC + JOC in Library Sciences.

All the facilities may be increased to meet the requirements in a phased manner.

12.3. Audiovisual Instruments: Appropriate instruments as per No. and level of course should be provided.

12.4. Space:

Sr. No.		Size (Sq. Ft.)	Graduate	Graduate and PG
a)	Class Rooms	Size should be adequate to accommodate (9 sq. ft. per student)	Half the No. of total batches/ course (Min. 2 class room)	Half the No. of total batches/ course (Additional 1 room for each PG course)

b)	Room for reception where patients are registered.			
c)	Room for case history, Speech Diagnostic Room and Interviews	(6 x 6)	5 for 20 intake and 8 for 40 intake	With one PG course 12 and with each additional PG 2 extra
d)	Speech Lab (Quiet Room) for diagnostic purposes.	(15 x 20)	1	1+1
e)	Recording room (Sound proof)	(10 x 10)	1	1
f)	Speech Therapy Rooms/ Cabins	(6 x 6)	12 *to accommodate 50% of the students)	12
g)	- Single sound treated room. - Two Room Audiometric suite with control and test room situation. (Sound Proof. ANSI 1977)	(10 x 18)	For 20 intake one room and for 40-two rooms	For each of PG program i.e., MASLP –one room extra
h)	Room for hearing aid trial combination purpose.	(10 x 15)	1	1+1
i)	Earmould Lab	(15 x 20)	1	1
j)	Staff Room	As per staff strength (min size 15x20)	1	-
k)	Individual work space (with provision for storage facilities)	(10 x 10)	4	12
l)	Hearing aid repair lab	(10 x 10)	1	1
m)	Principal's Office room	(12 x 16)	1	1
n)	Sanitary facilities	As per requirement separate facilities for girl and boy students and staff		

o)	Hostels for Men and Women to accommodate at least 50% of the student population.		
p)	Administrative staff room.		

12.5. Equipment (Minimum Requirement):

Sr. No.		Graduate	Graduate and PG
Audiology			
a)	2 channel Diagnostic Audiometer with Accessories such as earphone, ear cushion combination with adjustable headband, B.C. vibrator, transducers like microphone and matching loud speakers	1	1+1 and for Audiology specialization course one extra
b)	Portable Audiometer with provision of A.C. and B.C. testing : desirable screening audiometer	1 for each batch	1 + 1
c)	Clinical Immittance Audiometer (Desk model) with accessories.	2 instruments essential preferably one with screening type for field work. For 40 – three are required	1 more for MASLP and extra one for M.Sc. (Audio.)
d)	Portable/Screening impedance, audiometer	1	1 + 2
e)	Clinical BSEAR	1	1 + 1 (For M.Sc. [Audio.] stacked ABR and VEMP) are additions]
f)	Otoacoustic emission	1	1 more (one screening and two table models)
g)	Calibration equipment for AC, BC and free field (by possession or access)		

h)	Different types of Hearing Aids of mild moderate and strong categories body level and ear level, canal and spectacle hearing aid (1 each), FM, Digital, Programmable aids, ILS Assistive listening devices.	A representative sample of hearing aids and assistive devices	Software programs for HAT
i)	IGO and HAT for hearing aid trial and making electroacoustic measurements.	1	1
j)	Stop watch	2	2 more
k)	Oto scope	2	2 more
l)	Proformae		
m)	Auditory training and Screening material		
n)	Ear Mould Lab-fully equipped	UV Labs for Soft mould for PG course	

Speech Pathology			
a)	Speech and Language Tests (Tests for differential diagnosis) (English and local language)	As per course requirement	As per course requirement
b)	Proformae		
c)	Speech Therapy material (Indian, Language and English)		
d)	Toys and Books		
e)	Mirrors - size 2' x 3'	4	6
f)	Speech Trainer	1	2
g)	Portable and Digital tape recorders	4	6
h)	Hi-Fi Ampli Deck with speakers and good microphone	1	2
i)	Expirograph/Aerophone	1	1+1 (for M.Sc – SLP)

j)	Computer PC-AT with VGA Color Monitor	1	3
k)	Software for diagnostic/therapeutic use	1	1
l)	Endostroboscope	-	One for M.Sc (SLP)
m)	EKG	1	1
n)	Stop Watch	2	4
o)	Audio cassettes for training/CDs		
p)	Pitch pipe		
q)	Tongue depressors	3	5

M.Sc (Audiology) Semester Scheme

Scheme of Examination

Sem No.	Paper No.	Title of the Paper	Marks for		
			Theory	I.A.	Total
I	1.1	Research methods in speech-language & hearing	80	20	100
	1.2	Statistics in speech-language & hearing	80	20	100
	1.3	Technology for speech-language & hearing	80	20	100
	1.4	Auditory physiology	80	20	100
	1.5	Basics in auditory perception	80	20	100
II	2.1	Neurophysiology of hearing	80	20	100
	2.2	Psychophysics of audition in normals	80	20	100
	2.3	Speech Perception	80	20	100
	2.4	Physiological assessment of the auditory system	80	20	100
	2.5*	(a) Clinical Practicum (Internal) (b) Clinical Practicum Examination (External)	-- --	50 --	50 50
III	3.1	Psychophysics of audition in the hearing impaired	80	20	100
	3.2	Seminars in assessment of the hearing impaired	80	20	100
	3.3	Speech perception in clinical population	80	20	100
	3.4	Electrophysiological assessment of the auditory system	80	20	100
	3.5	Audiology in practice	80	20	100
IV	4.1	Assessment and management of central auditory processing disorders	80	20	100
	4.2	Seminars in rehabilitative audiology	80	20	100
	4.3	Implantable devices for the hearing impaired	80	20	100
	4.4*	(a) Clinical practicum (Internal) (b) Clinical practicum examination (External)	-- --	50 --	50 50
	4.5	Dissertation**			100

* (a) Clinical Practicum (Internal) shall begin from I / III Semester. The Internal Assessment marks are based on performance of I and II / III and IV Semesters' Clinical Work taken together.

** Candidates shall begin Dissertation work in III Semester

*** All papers to be taught in 60 hours

MASTER OF SCIENCE IN AUDIOLOGY

I Semester

1.1 RESEARCH METHODS IN SPEECH-LANGUAGE AND HEARING

Unit 1 **12hours**

- 1) Review of basic research methods, strategies and designs in Speech language pathology and Audiology.
- 2) 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.
- 3) Methods of Observation and measurement in speech language pathology and audiology.

Unit 2 **12hours**

- 1) Experimental designs. The structure and logic of experimental designs, single subject designs and group designs.
- 2) Documentation.
 - a) Organization, format and writing style.
 - b) Legal, ethical and cultural considerations for research in speech language pathology and audiology.

Unit 3 **12hours**

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.

Unit 4 **12hours**

Evolution of research methods in speech and hearing since 1920s.

Unit 5 **12hours**

- 1) Methods of experimental research in allied areas – Linguistics, Neurology, Clinical Psychology, Genetics, Physics and acoustics and their application to speech and Hearing.

2) Epidemiological research in Speech and Hearing.

1.2 STATISTICS IN SPEECH-LANGUAGE AND HEARING

Unit 1

12hours

Review of basic statistics, statistical measures and their features.
Statistical inference: Methods of correlation and regression, cause and effect relation, chi-square, population estimate, probability, probability laws and hypothesis testing. The concept, theoretical distributions, estimation-point and interval estimation. Application to speech-language pathology and audiology with specific examples.

Unit 2

12hours

Analysis of variance and covariance (ANOVA and ANCOVA): Basic models, assumptions, one way and two way classifications. Need for non-parametric tests. Consequence of failure of assumptions underlying ANOVA. Tests for additivity, homogeneity, transformation. Post – hoc tests analysis of covariance.Repeated measure.
Correlation, regression analysis and prediction including multiple regression and path analysis.

Unit 3

12hours

Non-parametric statistics: Non-normal distributions, central limit theorem.

Unit 4

12hours

Analysis of qualitative data: Contingency tables, measures of association, Kappa coefficient, log linear models. Content analysis.

Unit 5

12hours

Multivariate analysis: Need for multivariate analysis, various methods, principal component analysis, factor cluster, discriminant function, MANOVA, MANCOVA, multiple regression and path analysis, logistic regression multidimensional scaling.

1.3 TECHNOLOGY FOR SPEECH-LANGUAGE AND HEARING

Unit 1 - Introduction to Basic Electronics and Computers

12hours

- (a) Basic principle of operation and working of
 - Diodes, Transistors, FET's & UJT's, LED's, LCD's & IC's
 - D.C. Power supplies, a-c Voltage stabilizers and UPS
- (b) Fundamentals of Digital Electronics
 - Binary number system, Hex code, ASCII 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 soft-wares
 - Programs, Flow charts
 - Internet and networking of computers

Unit 2 - Fundamentals of Digital Signal processing and Communication systems

12hours

- (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
 - I I R system, its realization and implication
 - F I R system, its realization and implication
 - Basics of I I R and F I R filters and their implementation
- (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

12hours

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

Unit 4 - Technology of Hearing Aids & Speech Processing and Analysis

12hours

- (a) Principle and working of
 - Body level hearing aid
 - BTE hearing aid
 - Digital, DSP based/programmable hearing aids
 - FM hearing aid
- (b) Evaluation of hearing aids
 - Electro acoustic characteristics
 - National and Inter-national 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 - Advanced Technology for Speech and Language Disorders

12hours

- (a) Electro-physiological methods in diagnosis
 - Fundamental principles of EEG
 - 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

1.4 AUDITORY PHYSIOLOGY

Unit 1 **12hours**

- External Ear: Anatomy and physiology of lower animals and humans. Role of Pinna & External auditory meatus in hearing. Resonance properties of external ear in lower animals and human.
- Temporal bone anatomy.

Unit 2 **12hours**

Middle ear: Anatomy & Physiology of lower animals and humans.

- Middle ear transformer action
- Concept of acoustic impedance
- Acoustic and non acoustic reflex pathways
- Anatomy & physiology of the eustachian tube

Unit 3 **12hours**

Cochlea: Anatomy in lower animals and human

- Macro & microanatomy
- Blood supply
- Innervation
- Cochlear fluids - Origin, absorption, composition, dynamics and functions

Unit 4 - Physiology of the Cochlea: **12hours**

- 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.

Unit 5 - Theories of hearing: **12hours**

- Historical aspects.
- Place theory - resonance & nonresonance.
- Frequency theory.
- Traveling wave theory.
- Other recent advances like motor theory etc.
- Vestibular system:
Anatomy and physiology of Vestibular structure and vestibular nerve.

1.5 BASICS IN AUDITORY PERCEPTION

Unit 1 12hours

- a) Psychoacoustic
 - Introduction
 - Psychophysical methods
- b) Theory of signal detection
 - Basic concepts
 - Application

Unit 2 – Loudness 12hours

- MAP and MAF
- Equal loudness contours
- Loudness level
- Scaling
- Temporal integration
- Loudness of complex tones
- Loudness growth
- Parameters of loudness
- Psychophysical power law
- Recruitment in normal ears
- Relationship between loudness and pitch
- Differential sensitivity for frequency and intensity
- Absolute/relative DL's
- Methods for measuring DL's
- Clinical application

Unit 3 – Pitch 12hours

- Factors affecting pitch perception (intensity Frequency and duration)
- Pitch scales
- Pitch of complex tones
- Theories of pitch perception
- Ohm's acoustic law
- Objective beats
- Consonance, dissonance, musical intervals
- Combination tones
- Relationship between frequency and pitch
- JND for frequency
- Effects of phase on the pitch of complex sound

Unit 4 12hours

- a) Temporal processing in the auditory system
 - The detection of gaps in broad band noise
 - The detection of temporal gaps in narrowband sounds

- The detection of gaps in sinusoids
- Duration discrimination

b) Auditory pattern perception

- Timbre perception and object identification
- Time-invariant pattern and timbre
- Time varying patterns

Unit 5

12hours

a) Auditory object perception

- Information used to separate auditory objects
- Fundamental frequency
- Onset disparities
- Contrast with previous sounds
- Correlated changes in amplitude and frequency
- Sound location

b) Perception of temporal system

- Perception of rhythm
- Auditory streaming
- Judgement of temporal order
- General principles of perceptual organization
- Similarity
- Figure-ground phenomenon and attention

M.Sc II Semester

2.1 NEUROPHYSIOLOGY OF HEARING

- Unit 1** Auditory nerve: **12hours**
Anatomy
- Structure and tonotopic organization.
- Physiology
- Electrophysiology - Action potential, generation and properties.
 - Stimulus coding - frequency, intensity and temporal coding.
 - Non-linearity seen at auditory nerve.
- Unit 2 - Central auditory pathway:** **12hours**
- Anatomy:
- Ascending pathway and tonotopic organization at the different levels.
- Physiology:
- Neurophysiology of the central auditory pathway -stimulus coding.
- Unit 3 - Auditory Cortex:** **12hours**
- Anatomy and tonotopic organization of the primary and secondary auditory area.
 - Neurobiological relationship between auditory cortex and other areas
 - Physiology - Neurophysiology of the auditory area - stimulus coding.
- Unit 4** a) Efferent pathway: Anatomy **12hours**
Physiology:
- Effect on cochlear physiology and auditory nerve and CN.
 - Perception of auditory stimulus.
 - Protective function.
- b) Anatomy of the cranial nerves related to ear.
- Unit 5 - Neuro transmitters in the auditory system:** **12hours**
- Type of synapse
 - Physiology of the nerve
 - Neuro transmitters vs neuro modulator
 - Properties and function of neuro transmitter
 - Afferent and efferent neuro transmitters

2.2 PSYCHOPHYSICS OF AUDITION IN NORMALS

Unit 1 **12hours**

Masking and critical band concept

- Critical band concept
- Masking and excitation pattern
- Non-simultaneous masking
- Frequency resolution
- Tone-on-tone masking
- Relationship between masking level and threshold shift
- Central masking
- Pulsation threshold (continuity effect)
- Two-tone suppression

Unit 2 **12hours**

a) Adaptation

- Definition
- Adaptation Vs Fatigue
- Methods of studying adaptation
- Stimuli Parameters affecting adaptation
- Neurophysiological process in adaptation

b) Space perception

- Binaural hearing
- Localization Vs. lateralization
- Localization of puretones
- Cues for localization

Unit 3 **12hours**

Localization of complex tones

- The acuity of lateralizing transients
- Acuity as a function of frequency
- Onset disparities Vs ongoing disparities
- Time-intensity trading
- Binaural adaptation
- Binaural interference

Unit 4 **12hours**

Miscellaneous concepts related to space perception

- Monaural localization and role of pinnae
- The cone of confusion and the role of head movements
- Influence of vision on auditory localization

- Perception of distance
- Factors affecting localization
- Clinical application
- Performance in localization and lateralization
- (Beats, rotating tones, time separation pitch, time-intensity trade, masking level difference)
- Neurophysiological process
- Time-intensity trading
- Sluggishness of binaural system
- Binaural fusion of pulsed stimuli
- Models of binaural hearing
- JND for dichotic phase

Unit 5

12hours

Perception of music

- Musical scales/Musical notes
- Factors affecting perception of music

2.3 SPEECH PERCEPTION

- Unit 1** **12hours**
- a) Acoustic of speech in relation to production
 - b) Coding of speech in the auditory pathway
 - c) Theories of speech perception
 - Acoustic theory
 - Neurological theory
 - Auditory theory
 - Motor theory
 - Analysis by synthesis
 - d) Methods used to study speech perception
 - Analysis by synthesis
 - Parametric synthesis
 - Articulatory synthesis
- Unit 2** **12hours**
- a) Cues for perception of vowels and consonants in normals
 - b) Effects of co-articulation on speech perception
- Unit 3** **12hours**
- Dichotic listening
 - Theories
 - Factors affecting dichotic perception
 - Application in the field of speech and hearing
- Unit 4** **12hours**
- a) Short term memory and speech perception
 - Stages of memory
 - Theories of short term memory
 - Perception of consonants and vowels in short term memory
 - b) Animal perception
 - Perception of consonants and vowels
 - Categorical perception
 - Animal Vs. human perception
- Unit 5 - Infant perception** **12hours**
- Perception of consonants and vowels in infants
 - Comparison of adult and infant perception
 - Universality in speech perception

2.4 PHYSIOLOGICAL ASSESSMENT OF THE AUDITORY SYSTEM

Unit 1 – Tympanometry **12hours**

- a) Principle and instrumentation of immittance evaluation
- b) Tympanometry: Low frequency Vs. Multifrequency tympanometry, Single vs. Multicomponent tympanometry,
- c) Variables effecting tympanometry

Unit 2 - Reflexometry **12hours** Acoustic and non-acoustic reflexes, reflex adaptation, latency of acoustic reflex, reflex averaging, reflex sensitisation, temporal summation of acoustic reflex, binaural summation of acoustic reflex

Unit 3 - Application of Immitance **12hours** a) Variables effecting their measurement of acoustic reflexes b) Implication of immittance evaluation in differential diagnosis and management, Research needs in immittance evaluation.

Unit 4 **12hours**

- a) Origin of OAEs, classification of OAES
- b) Principles in recording of OAEs
- c) Interpretation of OAEs: Amplitude, latency, phase, and reproducibility

Unit 5 **12hours**

- a) Factors affecting measurement of OAE
- b) Contralateral suppression, ipsilateral suppression of OAE
- c) Implication in differential diagnosis and management, Research needs in OAE

M.Sc III Semester

3.1 PSYCHOPHYSICS OF AUDITION IN CLINICAL POPULATION

- Unit 1** **12hours**
- a) Threshold detection
- Psychometric function for human hearing with clinical population
 - Adaptative test procedures in audiology
- b) Loudness perception in person with hearing disorders **12hours**
- Recruitment
 - Dynamic range
 - Loudness adaptation
- Unit 2 - Pitch perception in person with hearing disorders** **12hours**
- Perception of pitch of pure tones
 - The frequency discrimination of pure tones
 - Perception of pitch of complex tones
- Unit 3 - Auditory Temporality in person with hearing disorders** **12hours**
- Temporal Integration
 - Differential Sensitivity for duration
 - Acoustic Temporal order
 - Auditory Numerosity
- Unit 4 - Masking Phenomenon** **12hours**
- Threshold shift in person with hearing disorders
 - Relationship between masking level and threshold shift in person with hearing disorders
 - Central masking
 - Forward and Backward masking in person with hearing disorders
- Unit 5** **12hours**
- a) Differential sensitivity & its measurement
- b) Binaural Hearing/ Binaural Amplification
- Temporal dimension of binaural hearing in person with hearing disorders
 - Binaural phenomenon in person with hearing disorders
 - Factors affecting Binaural hearing in person with hearing disorders

3.2 SEMINARS IN ASSESSMENT OF HEARING DISORDERS

Unit 1 12hours

Correlation of audiological findings to histopathological findings in

- a) Conductive hearing loss
- b) Genetic hearing loss
 - Tests for identifying genetic disorders including gene mapping, amniocentesis
 - Applications in management

Unit 2 12hours

Correlation of audiological findings to histopathological findings in Cochlear pathology and Retro-cochlear pathology

Unit 3 12hours

- a) Assessment of auditory disorders in the special population such as deaf-blind, MR, autism, cerebral palsy
- b) Assessment of patients with hyperacusis
 - condition/disorders in which it occurs
 - tests, interpretation
 - implications of findings in rehabilitation

Unit 4 12hours

- a) Evaluation of patients with Vestibular problems
 - condition/disorders in which it occurs
 - tests, interpretation
 - implications of findings in rehabilitation
- b) Tinnitus
 - Condition associated with tinnitus
 - Types of tinnitus
 - Evaluation

Unit 5 12hours

Non-audiological tests

- X-rays, PET, MRI, CT Scan, other tests
- Lab tests for differential diagnosis of auditory disorders

3.3 SPEECH PERCEPTION IN CLINICAL POPULATION

Unit 1 **12hours**

- a) Perception of vowels and consonants in person with hearing disorders
- b) Perception of coarticulation in person with hearing disorders
- c) Perception of suprasegments in person with hearing disorders

Unit 2 **12hours**

- a) Perception of speech through the visual modality - Perception of segmental and suprasegmental cues
- b) Perception of speech through the tactile modality - Perception of segmental and suprasegmental cues

Unit 3 **12hours**

- Perception of speech through cochlea implants modality
- Perception of segmental and suprasegmental cues through single channel implants
 - Perception of segmental and suprasegmental cues through multi channel implants
 - Comparison of speech perception through different devices

Unit 4 **12hours**

- Speech intelligibility
- Methods: Subjective and objective
 - Factors influencing
 - Application of Audiology

Unit 5 **12hours**

- a) Speech perception in adverse listening conditions
 - comparison of normals vs. person with hearing disorders
 - importance of S/N ratios
- (b) Application in research, evaluation and rehabilitation of person with hearing disorders

3.4 ELECTROPHYSIOLOGICAL ASSESSMENT OF THE AUDITORY SYSTEM

Unit 1 12hours

- a) Classification and generators of auditory evoked potentials
- Exogenous potentials such as Ecochg, ABR, MLR, LLR
 - Endogenous potentials such as P300, MMN, CNV
 - Steady state evoked potential
- b) General principle in recording of auditory evoked potentials
- Exogenous potentials such as Ecochg, ABR, MLR, LLR
 - Endogenous potentials such as P300, MMN, CNV
 - Steady state evoked potential

Unit 2 12hours

Factors affecting recording and interpretation of early responses (including Ecochg, ABR)

- Subject variables
- Stimulus variables
- Recording variables

Unit 3 12hours

a) Factors affecting recording and interpretation of middle latency response

- Subject variables
- Stimulus variables
- Recording variables

b) Factors affecting recording and interpretation of long latency response

- Subject variables
- Stimulus variables
- Recording variables

Unit 4 12hours

Factors affecting recording and interpretation of endogenous potentials such as P300, MMN, CNV.

- Subject variables
- Stimulus variables
- Recording variables

Unit 5 12hours

a) Factors affecting recording and interpretation of early responses, steady state evoked potentials

- Subject variables, Stimulus variables, Recording variables

b) Implications in differential diagnosis and management, research needs

3.5 AUDIOLOGY IN PRACTICE

Unit 1 **12hours**

- a) Audiological practice in rural/tribal areas (setting-up the center; equipment for the Center; test protocols; rehabilitation; follow-up)
- b) Audiological practice in a school setup (setting-up the center; equipment for the center; test protocols; rehabilitation; follow-up)

Unit 2 **12hours**

- a) Audiological practice in a paediatric setup (setting-up the center; equipment for the Center; test protocols; rehabilitation; follow-up)
- b) Audiological practice in an otorhinolaryngological setup (setting-up the center; equipment for the center; test protocols; rehabilitation; follow-up)
- c) Audiological practice in a neurological setup (setting-up the center; equipment for the center; test protocols; rehabilitation; follow-up)

Unit 3 **12hours**

- a) Audiological practice in an industrial setup (setting-up the center; equipment for the Center; test protocols; rehabilitation; follow-up)
- b) Audiologist as a private practitioner

Unit 4 **12hours**

- a) Medico-legal aspects in Audiology
 - Forensic audiology
 - Audiologist as a witness
 - Ethics in practice (in India and other countries)
- b) Legislation - International and national

Unit 5 **12hours**

- a) Welfare measures of the person with hearing disorders
- b) National/International Standards related to Audiology
 - Test environment
 - Equipment
 - Ear Protective Devices
 - Hearing aids

M.Sc IV Semester

4.1 ASSESSMENT AND MANAGEMENT OF CENTRAL AUDITORY PROCESSING DISORDERS

Unit 1 **12hours**

- a) Theoretical basis for CAPD problems
- b) Classification of CAPDs - Conditions in which CAPD exist

Unit 2 **12hours**

Behavioral tests in the assessment of CAPD – Paediatric, Adults

Unit 3 **12hours**

Objective test in the assessment of CAPD – Paediatric, Adults

Unit 4 **12hours**

- a) Correlation of audiological with non-audiological findings in CAPD
- b) Influence of linguistic variations in assessment and management

Unit 5 **12hours**

Management of CAPD

- Choice of management based on audiological test results
- Environmental modification
- Devices
- Auditory perceptual training
- Communication strategies
- Cognitive/ language management
- Recording improvement in therapy
- Others

4.2 SEMINARS IN REHABILITATIVE AUDIOLOGY

Unit 1 **12hours**

- a) Digital / programmable technology in hearing instruments - Applications in hearing aids, Assistive listening devices
- b) Signal enhancing techniques: including technology to improve SN ratio, frequency response shaping, spectral contrast enhancement, control feedback, reduce distortion and circuit noise, etc.

Unit 2 **12hours**

Electroacoustic performance of hearing instruments and ALDs, related standards

Unit 3 **12hours**

- a) Overview and rationale of selection procedures
 - hearing aids (linear and non-linear)
 - Assistive listening devices
 - Future trends in hearing aid fitting strategies
- b) Aural rehabilitation and effective counseling for:
 - hearing aid use
 - use of assistive listening devices

Unit 4 **12hours**

- a) Special needs for rehabilitation of children
 - Need for early intervention
 - Educational placement
 - Auditory learning; learning to listen
 - Strategies for management of multiply handicapped children
 - Language training for different age groups
 - Psychosocial aspects in rehabilitation
- b) Special needs for rehabilitation of geriatrics
 - Speech reading
 - Communication strategies
 - Assertiveness training
 - Strategies for management of individuals with associated problems
 - Psychosocial aspect in rehabilitation

Unit 5**12hours**

- a) Tinnitus management
 - Use of different techniques for individuals with normal hearing
 - Use of different techniques for individuals with degrees of hearing loss
- b) Hair cell regeneration, gene therapy for hearing loss

4.3 IMPLANTABLE DEVICES FOR PERSON WITH HEARING DISORDERS**Unit 1****12hours**

- a) Bone anchored hearing aids (BAHA)
 - Candidacy
 - Components
 - Types
 - Rehabilitation
 - Assessment of benefit
- b) Middle ear implants
 - Candidacy
 - Components
 - Types
 - Rehabilitation
 - Assessment of benefit

Unit 2**12hours**

- Cochlear implants
- Biological safety
 - Candidacy – pre-operative evaluation
 - Components
 - Types – design and features
 - Evaluation of benefits

Unit 3**12hours**

- a) Psychophysics of cochlear implants - Speech processor and strategies
 - Post-operative mapping and follow-up

Unit 4**12hours**

- a) Habilitation of infants and children with cochlear implants

b) Habilitation of adults with cochlear implants

Unit 5

12hours

- a) Other implantable devices including brainstem implant.
- b) Current trends and future needs in implantable devices

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M.Sc – IV Semester

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List of Journals for reference in subjects related to Audiology

Asia Pacific Journal of Speech, Language and Hearing

Audiology and Neuro-otology

British Journal of Audiology

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Language, Speech and Hearing Services in School

Noise and Health

Scandinavian Audiology

Seminars in Hearing

Hearing Aid Journal of India
