



UNIVERSITY OF MYSORE

M.Sc. (Audiology) CBCS and CAGP Regulations – 2016

1.0 Title and Commencement

1.1 These Regulations shall be called the University of Mysore regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for M.Sc. (Audiology) Programme. These Regulations shall come into force from the academic year **2016-17**.

2.0 Duration of the program

2.1 Duration of the program: 4 Semesters

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

3.0 Definitions

3.1 Course Every course offered will have three components associated with the teaching-learning process of the course, namely (i) Lecture – L (ii) Tutorial- T (iii) Practicum (Clinical) - P, where

L stands for Lecture session.

T stands for Tutorial session consisting participatory discussion / self study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

P stands for Practicum (Clinical) which would involve hands-on experience involving persons with communication disorders in clinical and other setups such as hospitals/clinics/ outreach centres.

A course shall have either or all the above components.

The total credits earned by a student at the end of the semester upon successfully completing the course are L + T + P. The credit pattern of the course is indicated as L: T : P.

Different courses of study are labelled and defined as follows:

3.2 Core Course

A course which should compulsorily be studied by a **student** as a core-requirement is termed as a Core course.

3.2.1 A Core course may be a **Soft Core** if there is a choice or an option for the **student** to choose a course from a pool of courses from the main discipline / subject of study or from a sister/related discipline / subject which supports the main discipline / subject. In contrast to the phrase Soft Core, a compulsory core course is called a **Hard Core** Course.



3.3 Elective Course

Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline / subject of study or which provides an extended scope or which enables an exposure to some other discipline / subject/domain or nurtures the **student's** proficiency/ skill is called an Elective Course. Elective courses may be offered by the main discipline / subject of study or by sister / related discipline / subject of study. A Soft Core course may also be considered as an elective.

An elective course chosen generally from an unrelated discipline / subject, with an intention to seek exposure is called an **open elective**.

An elective course designed to acquire a special/advanced knowledge, such as Supplement study/support study to a project work, and a **student** studies such a course on his own with an advisory support by a teacher is called a **Self Study Elective**.

A core course offered in a discipline / subject may be treated as an elective by other discipline / subject and vice versa.

3.4 Dissertation is a soft core of 7 credits involving **research on a specific topic and scientific report writing**

4.0 Eligibility for admission.

4.1 Students with a B.ASLP / B.Sc. (Speech & Hearing) degree fulfilling all the following criteria are eligible for admission:

4.1.1 Degree from the University of Mysore or any other University/ Institute considered as equivalent.

4.1.2 The program should be **approved by Rehabilitation Council of India (RCI), excluding Institutes of National Importance and Foreign programs.**

4.1.3 An average of not less than 50% of marks or **Equivalent CGPA** in the qualifying examination.

[**Note:** 'Average' refers to the average of the aggregate marks/**CGPA** of all the years/semesters of B.ASLP/ B.Sc. (Speech & Hearing)/equivalent programme].

4.2 Admission shall be made only on the basis of the marks obtained in the entrance examination conducted by the training institutes for this purpose as per their stipulated rules and regulations. (eligibility differs for categories)

Further, only those students who qualify in the entrance examination are eligible for admission.



4.3 Entrance Examination

- 4.3.1 The objective of entrance examination is to assess the knowledge and skill of the students in the subjects of B.Sc. (Speech & Hearing)/B.ASLP or equivalent.
- 4.3.2 The entrance examination shall be conducted as notified from time-to-time as per the rules and regulations of the training institute.
- 4.3.3 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 of University of Mysore.

5.0 Scheme of Instruction

- 5.1 Details of the structure of the programme including the number of hours for the L:T:P components is provided in **Annexure I**.
- 5.2 The syllabus of every paper is divided into four units.
- 5.3 Students shall attend camps/extension programs tour conducted by the institution.
- 5.4 A Master's Degree program is of 4 semesters duration. A **student** can avail a maximum of 8 semesters – 4 years (in one stretch) to complete the Master's Degree (including blank semesters, if any). Whenever a **student** opts for blank semesters, he /she has to study the prevailing courses offered by the department when he / she continues his / her studies
- 5.5 A **student** has to earn a minimum of 76 credits for successful completion of the master's degree. The 76 credits shall be earned by the **student** by studying **Hard Core, Soft Core, Electives, and Clinical Practicum**, as specified in the program. The degree shall be awarded on **successful completion of the program**.
- 5.6 Only such **students** who register for a minimum of 18 credits per semester in the first two semesters and complete successfully 76 credits in 4 successive semesters shall be considered for declaration of ranks, medals and are eligible to apply for student fellowship, scholarship, free ships and hostel facilities.

6.0 Attendance

- 6.1 Each course shall be taken, as a unit for purpose of calculating attendance and a **student** shall be considered to have put in the required attendance for the course, if he/she has attended not less than 80% in case of theory classes and 90% in case of clinical practicum.
- 6.2 A **student** who is having shortage of attendance in clinical practicum is permitted to make up this shortage by attending clinical work during vacation/s immediately after that semester and he /she has to study the prevailing courses offered by the department when he / she continues his / her studies.



Note: The candidates are permitted to avail this facility (6.2) in the I & III semesters only, with prior permission of the Head of the Institution.

6.3 A **student**, who fails to satisfy the requirement of attendance in a course, shall reregister for the same in case of HC, register for the same or alternative course in case of SC/OE when it is offered next. However not exceeding double the duration of the programme.

Note: This facility shall be available only **once** in the entire programme.

6.4 If a student represents his/her Institution in Sports/NSS/Cultural or any official activities, he/she is permitted to avail to a maximum of 15 days in a semester, based on the recommendation and prior permission of the Head of the Institution.

7.0 Medium of Instruction

The Medium of instruction shall be English.

8.0 Continuous assessments, earning of credits and award of grades

The evaluation of the students shall be based on continuous assessment. The structure for evaluation is as follows:

8.1 Assessment and evaluation processes happen in a continuous mode. However, for reporting purposes, a semester is divided into 3 discrete components identified as C₁, C₂, and C₃.

8.2 The performance of a student in a course will be assessed for a maximum of 100 marks as explained below.

8.2.1 The first component (C₁), of assessment is for 25 marks. This will be based on test, assignment, seminar. During the **first eight weeks of the semester**, the first 50% of the syllabus (**two units in a course**) will be completed. This shall be consolidated during the 8th week of the semester.

8.2.2 The second component (C₂), of assessment is for 25 marks. This will be based on test, assignment, seminar. The continuous assessment and scores of second half of the semester will be consolidated during the 16th week of the semester. During the second half of the semester the remaining units in the course will be completed.

8.2.2.1 The outline for continuous assessment activities for Component-I (C₁) and Component-II (C₂) will be proposed by the teacher (s) concerned before the commencement of the semester and will be discussed and decided in the respective Departmental Council. The **students** should be informed about the modalities well in advance. The evaluated courses/assignments during component I (C₁) and component II (C₂) of assessment are immediately returned to the **students** after obtaining acknowledgement in the register maintained by the concerned teacher for this purpose.

8.2.3 During the 18th -20th week of the semester, a semester-end examination of 2 hours duration shall be conducted for each course. This forms the third/final component of assessment (C₃) and the maximum marks for the final component will be 50.

Note: Model question paper pattern is as given in **Annexure - II**



8.3 Clinical Practicum

- 8.3.1 The clinical practicum examinations shall be in the main subjects of study, i.e., in Audiology.
- 8.3.2 Clinical practicum is part of all the semesters. The internal assessment will be conducted continuously, **throughout** the semesters. In the C_1 and C_2 , student will be assessed for Clinical skill/repertoire, **planning for assessment and management**, preparation and maintenance of clinical documents (test protocols, diary, lesson plans and progress report), Efficient use of time/skills in clinical work and Professional attitude/motivation/ aptitude for clinical work. C_3 will be based on clinical viva-voce. In the **Odd Semester**, viva-voce **will be** conducted by three **internal examiners consisting of clinical staff/faculty**, who shall examine the **students'** clinical skills (prior to the commencement of the theory examination). In the **Even Semester**, viva-voce will be conducted by two internal faculty to examine the **students'** clinical skills (prior to the commencement of the theory examination). However, the BoE on its discretion can also invite external examiners, if required

8.4 Dissertation work

- 8.4.1 There shall be 100 marks for dissertation work. Dissertation would be conducted by each candidate over a period of 2 semesters (III and IV semesters). Dissertation I of the semester III and Dissertation II of the semester IV shall be in the same course. The results of Dissertation would be announced only at the end of the IV semester consolidating the continuous assessment of the both Dissertation I and II.
- 8.4.2 Right from the initial stage of defining the problem, the **student** has to submit progress reports periodically and also present **the progress and hold** regular discussions with the guide. Components of evaluation are as follows:
- In the **III Semester**, C_1 **will be based on** Preparation of research proposal and will be assessed by the guide. C_2 will be **based on Presentation of** research proposal and will be evaluated by a panel of two members consisting of **the guide and an internal examiner**. C_3 **will be based on** Periodic progress and progress report following research proposal, to be awarded by the Guide. In the IV Semester, C_1 will be based on periodic progress and progress report. C_2 will be based on results of the study and draft report. Both C_1 and C_2 will be awarded by the guide. C_3 will be based on final viva-voce and evaluation of the report. This will be awarded by a panel of two members consisting of the guide and an internal examiner. Report evaluation will carry a weightage of 60% while viva-voce examination will be of 40% weightage.
- 8.4.3 The **students** shall submit three copies of dissertation before the commencement of theory examination of that semester. **Students** who fail to submit their dissertations on or before the stipulated date shall not be permitted to appear for the final **dissertation viva voce**.
- 8.4.4 A student who is said to have DROPPED dissertation work has to re-register for the same subsequently within the stipulated period.



- 8.5** In case a **student** secures less than **40%** in C_1 and C_2 put together in a course, the **student** is said to have **DROPPED** that course, and such a **student** is not allowed to appear for C_3 in that course.

In case a **student**'s attendance in a course is less than the stipulated percentage, the **student** is said to have **DROPPED** that course, and such a **student** is not allowed to appear for C_3 in that course.

Teachers offering the courses will place the above details in the Department Council meeting during the last week of the semester, before the commencement of C_3 , and subsequently a notification pertaining to the above will be brought out by the Chairman of the Department before the commencement of C_3 examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

In case a **student** secures less than **40% in C_3** , he/she may choose **DROP/MAKEUP** option.

In case a **student** secures more than or equal to **40%** in C_3 , but his/her grade (**G**) = **5**, as per section **8.9** below, then he/she may be declared to have been conditionally successful in this course, provided that such a benefit of conditional clearance based on **G = 5** shall not be availed for a maximum of 8 credits for the entire programme of Master's Degree.

In case a **student** secures more than **40%** in C_3 but **G=5**, then he/she may choose **DROP/MAKE-UP** option. The **student** has to exercise his/her option immediately within 10 days from the date of notification of results. **A MAKE-UP examination for odd semester courses will be conducted along with next regular odd semester examinations and for even semester courses along with the next regular even semester examinations. If a student is still unsuccessful, he/she may opt to DROP or again take up a MAKE-UP examination. However, not exceeding double the duration norm in one stretch from the date of joining the course.**

A **student** has to re-register for the **DROPPED** course when the course is offered again by the department, if it is a hard core course. The **student** may choose the same or an alternate core/elective in case the dropped course is soft core / elective course. A **student** who is said to have **DROPPED the course** has to re-register for the same subsequently within the stipulated period. The details of any dropped course will not appear in the grade card.

However, if a candidate secures less than 50% in C_3 of the clinical courses, no make-up examination would be given and candidate shall be considered to have dropped the course and re-register for the course.

8.6 Setting questions papers and evaluation of answer scripts.

- 8.6.1 I. Questions papers in three sets shall be set by internal / external examiners for a course.
- II. The Board of Examiners shall scrutinize and approve the question papers and scheme of valuation.



- III. There shall be single valuation for all theory papers by internal examiners. In case, the number of internal examiners falls short, external examiners may be invited. The marks awarded by the internal examiners shall be taken as the final marks for that particular course. The examination for **clinical work/dissertation** work will be conducted jointly by two internal examiners. However, the BoE on its discretion can also invite external examiners, if required.
- IV. Challenge valuation: A student who desires to apply for challenge valuation shall obtain a photocopy of the answer script by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Registrar (Evaluation) within 15 days after the announcement of the results. This challenge valuation is only for C₃ component.

The answer scripts for which challenge valuation is sought for shall be sent to another examiner. The marks awarded will be the higher of the marks obtained in the challenge valuation and in maiden valuation.

8.6.2 In case of a course with only practical component a practical examination will be conducted with two internal examiners. A student will be assessed on the basis of a) knowledge of relevant processes b) Skills and operations involved c) Results / products including calculation and reporting. The duration for semester-end practical examination shall be decided by the departmental council.

8.6.3 If a course has both theory and practical components with credit pattern L : T : P, then as parts of (C₁ and C₂) both theory and practical examinations shall be conducted for 50 marks each. The final (C₃) component marks shall be decided based on the marks secured by the student in the theory examinations. If **X** is the marks scored by the student out of 50 in C₃ in theory examination, if **Y** is the marks scored by the student out of 50 in C₃ in Practical examination, and if **Z** is the marks scored by the student out of 50 in C₃ for a course of (L=0):T:(P=0) type that is entirely tutorial based course, then the final marks M in C₃ is decided as per the following table.

L.T.P distribution	Find mark M in C3
L:T:P	$\frac{[(L+T)*X]+[(T+P)*Y]}{L+2T+P}$
L:(T=0):P	$\frac{(L*X)+(P*Y)}{L+P}$
L:T:(P=0)	X
L:(T=0):(P=0)	X
(L=0):T:P	Y
(L=0):(T=0):P	Y
(L=0): T:(P=0)	Z

8.6.4 The details of continuous assessment are summarized in the following Table.

Component	Syllabus in a course	Weightage	Period of Continuous assessment
C ₁	First 50% (2 units of total units)	25%	First half of the semester. To be consolidated by 8 th week
C ₂	Remaining 50% (Remaining units of the course)	25%	Second half of the semester. To be consolidated by 16 th week



C ₃	Semester-end examination (All units of the course)	50%	To be completed during 18 th -20 th Week.
Final grades to be announced latest by 24th week			

- 8.6.5 A student's performance from all 3 components will be in terms of scores, and the sum of all three scores will be for a maximum of 100 marks (25 + 25 + 50).
- 8.6.6 **Finally, awarding the grades should be completed latest by 24th week of the semester.**
- 8.7 The tentative / provisional grade card will be issued by the Registrar (Evaluation) at the end of every semester indicating the courses completed successfully. This statement will not contain the list of PENDING or DROPPED courses.
- 8.8 Upon successful completion of Masters degree, a final grade card consisting of grades of all courses successfully completed by the student will be issued by the Registrar (Evaluation).
- 8.9 The grade and the grade point earned by the candidate in the course will be as given below.

P	G	GP = V x G
40-49	5	V*5
50-59	6	V*6
60-64	6.5	V*6.5
65-69	7	V*7
70-74	7.5	V*7.5
75-79	8	V*8
80-84	8.5	V*8.5
85-89	9	V*9
90-94	9.5	V*9.5
95-100	10	V*10

Here, P is the percentage of marks ($P = [(C_1 + C_2) + M]$) secured by a student in a course which is rounded to nearest integer. V is the credit value of course. G is the grade and GP is the grade point.

- 8.10 A student also has an option to withdraw a course even after final examination, if he / she feels that he / she should improve in the course in terms of grade. The withdrawal of a course can be either only for C₃ components, in which the student has to reappear for only C₃ component to improve, carrying the marks of C₁ and C₂ components (this option is called PENDING option), or for the entire course where the student has to reenrol for the course afresh or can chose an alternative course if the withdrawal course is a soft/elective core (this option is called DROPPED option). This act of withdrawing should be immediately within seven days after the announcement of final results.
- 8.11 Overall cumulative grade point average (CGPA) of a student after successful completion the required number of credits (76) is given by

$$\text{CGPA} = \frac{\sum \text{GP}}{\text{Total number of credits (calculated up to 4 decimal places)}}$$



9. Classification of results:

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the student and is given as follows.

CGPA	FGP	
	Numerical Index	Qualitative Index
$4 \leq \text{CGPA} < 5$	5	SECOND CLASS
$5 \leq \text{CGPA} < 6$	6	
$6 \leq \text{CGPA} < 7$	7	FIRST CLASS
$7 \leq \text{CGPA} < 8$	8	
$8 \leq \text{CGPA} < 9$	9	DISTINCTION
$9 \leq \text{CGPA} \leq 10$	10	

Overall percentage = $10 * \text{CGPA}$

10.0 Provisions for Repeaters

10.1 A student is allowed to carry all the previous unleared courses except **clinical practicum** to the subsequent semester/semesters subject to Regulation 8.5

11 Provision for appeal

11.1 If a student, is not satisfied with the evaluation of C1 and C2 components, he / she can approach the grievance cell with the written submission together with all facts, the assignments, test papers etc, which were evaluated. He/she can do so before the commencement of semester-end examination. The grievance cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the university on the student if his/her submission is found to be baseless and unduly motivated. This cell may recommend taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cell is final.

11.2 For every program there will be one grievance cell. The composition of the grievance cell is as follows.

- 1.The Registrar (Evaluation) ex-officio Chairman / Convener
- 2.One senior faculty member (other than those concerned with the evaluation of the course concerned) drawn from the department/discipline and/or from the sister departments/sister disciplines.
- 3.One senior faculty members / subject experts drawn from outside the University department.

12.0 Barring of simultaneous study

12.1 No student admitted to the degree programme in a College/Institution under the jurisdiction of this University shall be permitted to study simultaneously in any other programme leading to a degree (regular, evening & morning) offered by this or any other University.

12.2 If a student gets admitted to more than one programme, the University shall cancel without giving prior notice, his/her admission to all the programmes to which he/she has joined.



13.0 Miscellaneous

- 13.1 These revised regulations will apply to students admitted for the academic year 2016-17 and onwards.
- 13.2 Any other issue, not envisaged above, shall be resolved by the Vice Chancellor in consultation with the appropriate bodies of the university, which shall be final and binding.

REGISTRAR

VICE-CHANCELLOR



Annexure - I

M.Sc. (Audiology) CBCS and CAGP Course Structure– 2016

Sl. No.	Course No.	Credit L:T:P	Credits	Total Credits	No. of Hrs (Hr x Cr = Hr)	No. of Hrs/wk	Total hrs/Wk	HC/ SC /OE	Title of the Course
I	1.1	2:1:0	3	18	L=1x2=2 T=2x1=2	4	35	HC	Research methods and Statistics in Speech-Language & Hearing
	1.2	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Auditory Perception
	1.3	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Physiological Assessment of the Auditory System
	1.4 a	2:1:0	3		L=1x2=2 T=2x1=2	4		SC	Auditory Physiology OR Technology for Speech-Language & Hearing
	1.4 b								
	1.5 a	1:1:0	2		L=1x1=1 T=2x1=2	3		SC	Diseases of the ear and auditory pathway OR Clinical Counselling
	1.5 b								
1.6*	0:0:4	4	C=4x4=16^	16	HC	Clinical Practicum I			
II	2.1	2:1:0	3	20	L=1x2=2 T=2x1=2	4	39	HC	Psychophysics of Audition
	2.2	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Electrophysiological Assessment of the Auditory System
	2.3 a	2:1:0	3		L=1x2=2 T=2x1=2	4		SC	Neurophysiology of Hearing OR <i>Speech Production</i>
	2.3 b								
	2.4 a	1:1:0	2		L=1x1=1 T=2x1=2	3		SC	Age related changes in audio-vestibular system OR Clinical Behavior Analysis
	2.4 b								
	2.5	(4 credits)	4			4		OE	
	2.6*	0:0:4	4		C=4x4=16^	16		HC	Clinical Practicum II
	2.7 a	0:0:1	1		C=4x1=4^	4		SC	Examination of ear with different pathology OR Speech synthesis OR LD evaluation and therapy
2.7 b									
2.7 c									



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Sl. No.	Course No.	Credit L:T:P	Credits	Total Credits	No. of Hrs (Hr x Cr = Hr)	No. of Hrs/wk	Total hrs/Wk	HC/SC/OE	Title of the Course	
III	3.1	2:1:0	3	21	L=1x2=2 T=2x1=2	4	40	HC	Implantable Devices for individuals with hearing impairment	
	3.2	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Speech Perception	
	3.3	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Seminars in assessment of hearing impairment	
	3.4	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Seminars in Rehabilitative Audiology	
	3.5 a	2:1:0	3		L=1x2=2 T=2x1=2	4		SC	Vestibular system: assessment & management OR Auditory Physiology** OR Technology for Speech-Language & Hearing**	
	3.5 b									
	3.5 c									
	3.6*	0:0:4	4	C=4x4=16^	16	HC	Clinical Practicum III			
	3.7***	D	2	D=2x2=4^	3+1^	SC	Dissertation in Basic Hearing Sciences-I OR Dissertation in Audiological Evaluation-I OR Dissertation in Rehabilitative Audiology-I			
IV	4.1	2:1:0	3	17	L=1x2=2 T=2x1=2	4	33	HC	Assessment and Management of Central Auditory Processing Disorders	
	4.2	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Audiology in Practice	
	4.3	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Speech Perception in Clinical Population	
		4.4*	0:0:4		4	C=4x4=16^		16	HC	Clinical Practicum IV
		4.5***	D		5	D=1x4=4^		4+1^	SC	Dissertation in Basic Hearing Sciences-II OR Dissertation in Rehabilitative Audiology-II OR Dissertation in Audiological Evaluation-II
				76						

***To register in the later clinical practicum the student should have passed all the earlier clinical practicum**

**** Available only for students who have not taken the course in the earlier semester/s**

***** To register into a particular soft core course in Dissertation II, candidate should have completed Dissertation I in the same course**



^ One hour each would be used for CC/JC

To enrol for 2.3 a the candidate should have enrolled and attended classes in 1.4 a

Please note:

L: One hour of lecture = 1 credit

T: Two hours of tutorials = 1 credit

P: Four hours of clinical practicum = 1 credit

D: Dissertation

REGISTRAR

VICE-CHANCELLOR

SEMESTER I

Paper Code: AUD 1.1 - HC: Research Methods and Statistics in Speech – Language and Hearing

Objectives

After successful completion of this course the students should be able to:

1. Understand and deduce the use of research methods.
2. Choose appropriate research designs to carry out research in the field.
3. Apply statistics in the field of Speech-Language Pathology and Audiology.
4. Critically evaluate the research designs and statistics in research publications.

Unit 1: Research strategies and their statistical counterpart 18 Hrs

1.1 Overview of variables

- Dependent
- Independent
 - Active and attribute
 - Continuous and categorical variables
- Extraneous and control variables

1.2 Quantitative Research

- Experimental research
 - Bivalent
 - Multivalent
 - Parametric
- Descriptive research
 - Comparative research
 - Developmental research
 - Correlational research
 - Survey research
 - Retrospective research
- Combined experimental and descriptive research

1.3. Qualitative research

- Observational research
- Interview research
- Narrative research
- Case study research

1.4. Documentation

- Organization
- Formatting

1.5 Writing style: Theses and journal articles

Unit 2 : Research designs 18 Hrs

- 2.1 Group designs
 - Within group
 - Between group
 - Mixed designs
- 2.2 Single subject designs
 - Withdrawal and reversal design
 - Multiple base line
 - Changing criterion design
- 2.3 Treatment Designs
 - Pre-experimental
 - Quasi experimental
 - True experimental
- 2.4 Evidence based practice
 - Generalization of research findings
 - Levels of evidence
 - Barriers to evidence-based practice
- 2.5 Validity of research designs
 - Internal validity
 - External validity

Unit 3: Parametric tests and its application 18 Hrs

- 3.1 Overview of basic statistics
 - Measures of central tendency
 - Measures of dispersion
 - General properties of normal distribution
 - Variants from normal distribution
 - Methods of correlation
- 3.2 Simple and multiple linear regression (with numerical examples)
- 3.3 Hypotheses and testing of hypotheses
- 3.3 Testing the significance between two means (with numerical examples)
 - Independent samples t-test
 - Paired sample t-test
- 3.4 Analysis of variance (ANOVA)
 - Types of ANOVA
 - Basic model
 - Assumptions underlying ANOVA
 - One-way and two-way ANOVA (with numerical examples)
 - Need for Post-hoc tests
 - Concept of repeated measures ANOVA and ANCOVA

3.5 Multivariate data analysis (concept only)

- Need for multivariate data analysis
- Introduction to various methods
 - Principal component analysis
 - Cluster analysis
 - Discriminant analysis
 - MANOVA

Unit 4: Non-parametric tests, qualitative data analyses and their application 18 Hrs

4.1 Consequences of failure of assumptions underlying parametric tests

4.2 Need for transformations and non-parametric tests

4.3 Non-parametric tests for independent samples (with numerical examples)

- Median test
- Mann-Whitney U test
- Kruskal-Wallis test

4.4 Non-parametric tests for related samples (with numerical examples)

- Sign test
- Wilcoxon's signed-rank test
- Friedman's test

4.5 Analysis of qualitative data (with numerical examples)

- Contingency tables
- Chi-square test for independence of attributes
- Measures of Association- contingency coefficient and Cramer's
- Measures of agreement - Kappa coefficient

Practicum:

1. Review research methods and statistics used in publications in the field of communication disorders in blocks of 5 years from 1970.
2. Two journal articles should be reviewed by each student for variables, research methods and appropriateness of statistics.

Reference:

Unit 1:

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Unit 2:

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Unit 3

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10. Seigal, S. (1956). Non-parametric Statistics for the Behavioral Sciences. Tokyo: McGraw Hill.

Paper Code: AUD 1.2 - HC: Auditory Perception

Objectives

After studying this course student will be familiarized:

1. With various psycho-acoustical procedures used for assessing the functions of auditory system,
2. With the effects of sensori neural hearing loss of varying degrees and configuration on different psycho-acoustic tasks.
3. With outcomes and implications of these psycho-acoustic tasks.
4. With analyses and interpretation of results from psychophysical experiments

Unit 1: Introduction to Psycho-Acoustics 18 Hrs

1.1 Physical description and parameters for generation of sounds

- Sine wave and complex signals
- Analysis of sound: Spectrum and spectrogram, LTASS
- Filters and their properties

1.2 Theory of signal detection

- Basic concepts
- Applications

1.3 Psychophysical methods

- Classical methods
- Adaptive methods

Unit 2: Absolute and Relative Thresholds 18 Hrs

2.1 Overview of absolute and relative measures

- Methods of measuring absolute and relative threshold (Difference limen for physical parameters of sound)
- Thresholds of audibility (MAP & MAF)

2.2 Loudness perception in individuals with normal hearing and in individuals with hearing impairment (different degrees, configuration and types)

- Dynamic range of hearing, equal loudness contours and loudness scaling.
- Models of loudness.
- Factors affecting loudness: Bandwidth, duration, adaptation and masking.
- DLI
- Recruitment and softness imperception
- Consequences of altered loudness perception

2.3 Pitch perception in individuals with normal hearing and in individuals with hearing impairment (different degrees, configuration and types)

- Theories of pitch perception
- Pitch Scales
- Perception of pure-tones
 - Frequency discrimination
 - Pitch perception of pure-tones

- Effect of intensity on pitch
- Perception of complex signals
 - Theories of pitch perception for complex signals
 - Missing fundamental
 - Discrimination of complex tones
 - Consequences of altered pitch perception

Unit 3: Frequency selectivity in individuals with normal hearing and in individuals with hearing impairment (different degrees, configuration and types) 18 Hrs

3.1 Measurement of frequency sensitivity using masking experiments

- Critical band concept and power spectrum model.
- Estimating the shape of auditory filter
 - Psycho-physical tuning curve
 - Notched noise
 - Non-simultaneous masking
- Masking patterns and excitation patterns.

3.2 Non-peripheral masking phenomena

- Central masking
- Informational masking
- Overshoot phenomena
- Co-modulation masking release
- Consequences of reduced frequency selectivity

Unit 4: Temporal processing in individuals with normal hearing and in individuals with hearing impairment (different degrees, configuration and types) 18 Hrs

4.1 Overview of temporal processing

- Temporal resolution
- Temporal integration
- Models of temporal processing

4.2 Detection and discrimination of gaps in

- Broad band noise
- Narrow band noise
- Sinusoids

4.3 Temporal modulation transfer function using

- Broad band noise
- Narrow band noise
- Sinusoids

4.4 Discrimination of modulation frequency

4.5 Consequences of altered temporal processing

Practicum:

- Generation of sinusoid and complex signals, LTASS of complex signals.
- Measure loudness curve/growth function (Magnitude scaling), growth of masking on 5 individuals with normal hearing.
- Measure temporal integration on 5 individuals with normal hearing.
- Measure TMTF on 5 individuals with normal hearing.
- Carry out non simultaneous masking on 5 individuals with normal hearing.
- Measure PTC on 2 individuals with normal hearing.

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Unit 1: Introduction to psycho-acoustics

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Unit 2: Absolute and relative thresholds

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Unit 3: Frequency selectivity in individuals with normal hearing and in individuals with hearing impairment (different degrees, configuration and types)

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12. Stanley, A. Gelfand (1998). Hearing. New York: Marcel Dekker Inc.

Unit 4: Temporal processing in individuals with normal hearing and in Individuals with hearing impairment (different degrees, configuration and types)

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Paper Code: AUD 1.3 - HC: Physiological Assessment of the Auditory System

Objectives

After completing this course, the candidate shall be able to

1. Describe the bases of physiological tests
2. Independently administer different physiological tests, interpret the findings
3. Make need-based modifications in the test protocol
4. Prepare research proposal to conduct research in the domain of physiological tests

Unit 1: Tympanometry 18 Hrs

- 1.1 Overview of principles and instrumentation of immittance evaluation
- 1.2 Overview on Single component tympanometry and its applications
- 1.3 Multi-frequency and multi-component tympanometry
- 1.4 Variables affecting multiple component and multi-frequency tympanometry
- 1.5 Tympanometry in infants
- 1.6 Implication of tympanometric evaluation in differential diagnosis and management
- 1.7 Wideband reflectance/absorbance and wideband tympanometry: Bases, instrumentation, test administration, interpretation and clinical applications

Unit 2 - Reflexometry 18 Hrs

- 2.1 Overview of Acoustic reflexes: pathway, test protocol, administration and clinical implications
- 2.2 Reflex patterns in different pathologies
- 2.3 Overview on special tests of acoustic reflexes and their applications: Reflex adaptation, latency of acoustic reflex, reflex averaging, reflex sensitization, Temporal summation of acoustic reflex, binaural summation of acoustic reflex
- 2.4 Variables affecting their measurement of acoustic reflexes
- 2.5 Importance of high frequency reflexometry in paediatric assessment
- 2.6 Reflectometry
- 2.7 Non-acoustic reflexes: pathway, test protocol, administration and clinical implications
- 2.8 Research needs in middle ear muscle reflexes

Unit 3: Otoacoustic emissions 18 Hrs

- 3.1 Origin of OAEs
- 3.2 Classifications of OAEs **with special focus on mechanism based taxonomy**
- 3.3 Principles and recording techniques of different types of OAEs
- 3.4 Interpretation of OAEs: amplitude, latency, phase, and reproducibility
- 3.5 Instrumentation of SOAE

- 3.6 Recording of SOAE
- 3.7 Synchronized SOAE
- 3.8 Factors affecting SOAE
- 3.9 SOAE & tinnitus
- 3.10 Clinical applications of SOAE
- 3.11 Suppression of SOAE

Unit 4: Evoked oto-acoustic emission 18 Hrs

- 4.1 Instrumentation of TEOAE/DPOAE /SFOAE
- 4.2 Techniques for recording TEOAE/ DPOAE/SFOAE
- 4.3 Factors affecting TEOAE/DPOAE/ SFOAE
- 4.4 Fine structure DPOAEs
- 4.5 Evoked OAEs & tinnitus
- 4.6 Clinical applications of TEOAE/ DPOAE /SFOAE
- 4.7 Contralateral & ipsilateral suppression of TEOAE/DPOAE/SFOAE: Procedure & applications
- 4.8 Implications in differential diagnosis and management
- 4.9 Research needs in OAEs

Practicum:

- Immittance evaluation
- Draw vector plots for
 - middle system at resonance,
 - mass dominated middle ear system
 - Stiffness dominated middle ear system
- Measure admittance in the calibration cavities of various volumes and note down the observations
- Calculate Equivalent ear canal volume by measuring static admittance in an uncompensated tympanogram (10 ears)
- Record tympanogram in the manual mode and measure peak pressure, peak admittance and ear canal volume manually using cursor (5 ears).
- Interpret hypothetical case results indicating the presence of various middle ear pathologies (5 cases)
- Vary different stimulus and procedure related parameters and measure tympanogram to witness their effects. Few of the mandatory parameters are, probe tone frequency, rate of pressure change, direction of pressure change, number of trials, probe insertion depth, sneezing before measurement, speaking while measurement (5 ears)

- Carry out Acoustic reflex decay test and quantify the decay manually using cursor (5 individuals).
- OAEs
- Setting protocol for recording TEOAEs and DPOAEs
- Record TEOAEs, SFOAE, SOAE and DPOAE and note down the amplitude, SNR, noise floor and reproducibility at octave and mid-octave frequencies. Note down the stimulus stability and the overall SNR (3 ears each).
- Record ipsilateral and contralateral suppression of TE and DPOAEs and note down the suppression magnitudes

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Unit 1 & 2: Tympanometry, Reflexometry

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Unit 3: Oto-acoustic emissions, evoked oto-acoustic emission

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3. Hall, J. W. (2000). *Handbook of Otoacoustic Emissions*. San Diego: Singular Publishing Company.
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Unit 4: Evoked oto-acoustic emission

1. Shera, C.A., & Guinan, J.J. Jr. (1999) Evoked otoacoustic emissions arise by two fundamentally different mechanism: A taxonomy for mammalian cochlea. *JASA*, 105 (2), 782-98.
2. Sahley, T.L., Nodeer, R.H., & Musiek, F.E. (1997). *Efferent auditory system: Structure and function*. San Diego: Singular Publishing Group Inc.
3. Kemp, D. T. (1978). Stimulated acoustic emissions from within the human auditory system. *Journal of Acoustical Society of America*, 64, 1386-1391.
4. Mills, D. M., & Rubel, E. W., (1994). Variation of distortion product otoacoustic emissions with furosemide injection, *Hearing Research*, 77, 183-199

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1. Katz, J. (Ed.). (1994). *Handbook of Clinical Audiology*. Baltimore: Williams and Wilkins.
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3. Rintleman, W.F. (1991). *Hearing Assessment*. Boston: Allyn and Bacon.
4. Roser, R.R., Valente, M., & Hosford-Dunn, D (Eds.) (2000). *Audiology: Diagnosis*, New York, Thieme.
5. Van De Water, T.R., Popper, A.N., & Fay, R.R. (Ed) (1996). *Clinical aspects of hearing*. New York: Springer

3.5 Nutrients related to sensory cell physiology

3.6 Physiology of auditory system in non mammalian species

Unit 4: Vestibular system 18 Hrs

4.1 Anatomy and physiology of peripheral vestibular system

- Semicircular canals
- Utricle
- Sacculle
- Vestibular nerve

4.2 Anatomy of the central vestibular pathway and its connections

- Brainstem
- Cerebellum
- Vestibular cortex

4.3 Reflexes involving the vestibular system

- Vestibulo-ocular reflex- pathways from each of the semicircular canals, cranial nerves involved (cranial nerves II, IV and V)
- Vestibulospinal reflex
- Sacculocollic reflex

4.4 Other systems involved in balance

- Proprioceptive (somatosensory) system- location of various receptors, strategies used for maintaining balance like ankle, hip, and step strategies
- Visual system- Various kinds of eye movements like gaze, saccade, optokinetic and pursuit

4.5 Association between vestibular system and cognition

Practicum:

1. Measure head related transfer function on 5 individuals
2. Measure the ear canal SPL and spectrum from different azimuths of sound
3. Measure non acoustic reflex on 5 individuals
4. Measure non linearity in auditory system using
 - Loudness growth function
5. OAEs

Reference:

Unit 1: Conductive mechanism of auditory system

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2. De Reuck, A. V. S. & Knight, J. (1968). Hearing mechanisms in vertebrates. London: Churchill.

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Unit 2: Anatomy of the sensory auditory system

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2. Brown, R. D., & Daigneault, E. A. (1981). Pharmacology of hearing. New York: John Wiley & Sons
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Unit 3: Physiology of the sensory and auditory system

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2. Berlin, C. I. (1996). Hair cells and hearing aids. San Diego: Singular Publishing Group.

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Unit 4: Vestibular system

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Paper Code: AUD 1.4 b - SC: Technology for Speech-Language & Hearing

Objectives:-

After successful completion of the course student should be able to:

1. Give an overview of the latest technology involved in speech acoustics, signal processing and instrumentation.
2. Provide fundamental concepts of the technology used in the instruments for diagnostics and therapeutics in Audiology, Speech Language Sciences and Pathology
3. Understand the basic technology used in hearing aids & cochlear implants.
4. Understand the principle of working and utility of equipment used for measurement of sound and calibration of diagnostic equipment.
5. Perform calibration of diagnostic instruments.
6. Lay the foundation of Information and Communication Technology (ICT) concepts and illustrate its applications in *Audiology*, Speech & Language Sciences & Pathology.

Unit 1: Transducers, signal processing components & power supply 12 Hrs

1.1 Transducers used in speech, language and hearing

- Microphones: Basic structure & principle of operation of dynamic, condenser and electret microphones.
- Essential characteristics of microphones for recording, speech analysis and speech audiometry
- Loudspeakers: Basic structure & principle of operation of dynamic loudspeaker, moving coil and balanced armature type receivers
- Essential characteristics of headphones and insert receivers used in audiology

1.2 Signal Processing components

- Role of preamplifiers and power amplifiers
- Filters: Types and their role

1.3 Power supply

- Requirements for mains supply to clinics
- Internal power supply of instruments
- Uninterrupted power supply for entire clinic vs. individual instruments

Unit 2: Introduction to digital signal processing and information & communication technology 12 Hrs

2.1 Digital signal processing

- Basic structure of a digital signal processing system
- Process of analog to digital conversion

- Process of digital to analog conversion
- Basic concepts of digital signal processing: decomposition, processing and synthesis
- Implementation of signal processing functions using DSP

2.2 Information technology

- Introduction to computer architecture
- Role of operating systems
- Role of RAM and hard disk
- Structure and functioning of computer networks

2.3 Communication technology

- Frequency modulation & its applications in group hearing aids
- Basic structure of a satellite communication system
- Concept of world wide web
- Basic structure of internet connectivity
- Tele-diagnosis & tele-rehabilitation system.

Unit 3: Technology involved in hearing aids, cochlear implants and speech processing & analysis 15 Hrs

3.1 Technology involved in hearing aids

- Basic technology of a digital hearing aid
- Technologies for non-linear amplification
- Technologies for noise suppression
- Technologies for feedback cancellation

3.2 Technology involved in cochlear implants

- Basic architecture of a cochlear implant
- Basic technology of speech processor

3.3 Fundamentals of speech signal processing

- Representing a speech signal in time domain
- Converting from time domain to frequency domain
- Short time analysis techniques

3.4 Techniques of speech analysis & applications

- LPC analysis
- Cepstrum analysis
- Speaker recognition
- Speech synthesis
- Speech to text conversion

Unit 4: Instrumentation in audiology, speech & language 15 Hrs

4.1 Instrumentation in speech & language

- Speech spectrograph and computerised analyses of speech

- Voice analyses systems
- Electroglotograph
- Articulograph
- Nasometer
- Fibre optic endoscope

4.2 Instrumentation in audiology

- Audiometer
- Middle ear analyzer
- Otoacoustic emission analyzer
- Instrumentation for auditory evoked potentials
- Multichannel EEG and ERP systems
- Equipment and components used for measurement of sound and calibration

4.3 Room acoustics, measurements & electric grounding

- Noise auditing
- Measurement of reverberation time
- Audiometric test room
- Recording room
- Procedure to make a perfect electric ground

4.4 Fundamentals of imaging technology

- X-Ray
- C-Arm
- CT scan
- MRI
- fMRI
- PET
- SPECT

Practicum:

1. Observe the operation of transducers.
2. Measure sound & noise
3. Calibration of audiometer/EGG
4. Measurement of reverberation time & ambient noise
5. Checking electrical grounding

References:

Unit 1: Transducers, signal processing components & power supply

1. Crocker, M.J. (1998). *Handbook of Acoustics*. New York: John Wiley & Sons, Inc.,
2. Rossing, T.D. (2002). *The Science of Sound*. 3rd Edn., Glenview: Pearson Education, Inc.,

3. Vonlanthen, A. (2007). *Hearing Instrument Technology for the Hearing Health Care Professionals*. London: Singular Publishing Group
4. Dillon, Harvey (2001). *Hearing Aids*. New York: Thieme Medical Publications.
5. Katz, J. (2009). *Handbook of Clinical Audiology 6th Edn.* Philadelphia: Wolters Kluwer.

Unit 2: Introduction to digital signal processing and information & communication technology

1. Nagpal, D. P. (2009). *Computer Fundamentals: Concepts, Systems and Applications*. New Delhi: S. Chand and Company.
2. Malvino, A. P. (1979). *Digital Computer Electronics*. Bombay: Tata McGraw Hill.
3. Kennedy, B. (1993). *Electronic Communication Systems.4th Edn.* Bombay: Tata McGraw Hill.
4. Hersh, M. A., & Johnson, M.A. (2003). *Assistive Technology for the Hearing Impaired Deaf and Deaf-blind*. London: Springer
5. Tan, Li Jiang. (2013). *Digital Signal Processing: Fundamentals and Applications 2nd ed.* New York: Academic Press Inc

Unit 3: Technology involved in hearing aids, cochlear implants and speech processing & analysis

1. Schaub, Arthur. (2008). *Digital Hearing Aids*. New York: Thieme Medical Publishers Inc.
2. Niparko, John K. (2009). *Cochlear implants - Principles and Practices - 2nd Edn.* New York: Lippincott Williams & Wilkins
3. Valente, Michael. (2002). *Hearing Aids: Standards, Options and Limitations:* Thieme Medical Publishers.
4. Sandlin, R.E. (2002). *Handbook of Hearing Aid Amplification, Vol. I: Theoretical and Technical Considerations*, London : Singular Publishing Group, Inc.

Unit 4: Instrumentation in audiology, speech & language

1. Kent, R. D. (1995). *The Acoustic Analysis of Speech*, Delhi: AITBS Publishers, Inc.
2. Khandpur, R.S. (1993). *Hand Book of Bio-Medical Instrumentation*. Bombay: Tata McGraw Hill
3. Jacobson, John T. (1985). *Auditory Brainstem Response*. London: Taylor and Francis Ltd.
4. Hall, James W. (2000). *Handbook of Otoacoustic Emissions*. New York : Delmar Cengage Learning.
5. Katz, J. (2009). *Handbook of Clinical Audiology. 6th Edn.* Philadelphia: Wolters Kluwer.

Paper Code: AUD 1.5 a - SC: Diseases of the Ear and Auditory Pathway

Objectives: After successful completion of the course student will

1. Understand clinical anatomy and physiology of the auditory system
2. Obtain knowledge about the pathophysiology of diseases related to the ear.
3. Have a holistic view about assessment and management of audio vestibular problems.

Unit 1: Anatomy and physiology of the auditory system

12 Hrs

- 1.1 Anatomy: External ear, middle ear and inner ear (labyrinth, cochlea, organ of corti, vascular supply of the ear, vestibulocochlear nerve), central auditory pathways and its connection.
- 1.2 Structure and function of nervous system: Central and peripheral nervous system, synapse and chemical mediators, circle of willis, cerebral cortex in hearing, cranial nerves.
- 1.3 Neurophysiology: Action potential, summing potential, neuromuscular junction, CSF, central auditory pathway and its disorders

Unit 2: Diseases of the external and middle ear

18 Hrs

- 2.1 Congenital malformations,
- 2.2 Diseases of the external ear: Otitis – externa, neoplasms of external ear, cerumen, keratosis obturans, injuries, sebaceous cysts, acquired atresia , stenosis of external auditory canal & malignant otitis externa
- 2.3 Diseases of the middle ear cleft: Otosclerosis otitis media, non suppurative otitis media, ,complications of middle ear diseases, neoplasms.
- 2.4 Diseases of the Otic capsule: Menieres disease, injuries, miscellaneous conditions of the otic capsule, CP angle tumor, trauma, inflammatory conditions, presbycusis, NIHL, sudden SNHL central deafness,
- 2.5 Reconstruction of middle ear hearing mechanisms: Reconstructive and rehabilitation procedures

Unit 3: Diseases of the cochlea 12 Hrs

- 3.1 Ototoxicity: Cochleotoxic and vestibule- toxic drugs and its effects,
- 3.2 Anatomical and physiological correlates in ototoxicity, epidemiology and mechanism
- 3.3 Systemic toxicity, topical toxicity, interventions, therapeutic uses of ototoxic drugs and pharmacology related to it
- 3.4 Medico-legal issues.

Unit 4 Vestibular system 12 Hrs

- 4.1 Medical and surgical management of problems of ear causing communication disorders
- 4.2 Vestibular system: Medical, surgical, rehabilitative management

Practicum:

Observation of the following:

- ENT examination of
 - History taking
 - Diagnostic procedures
 - Microscopic examination & procedures
 - Otoscopy / Otoendoscopy
 - Equipments & instruments
 - Vertigo
- Various pathological conditions of the ear
- Surgical procedures in operation theatre Log book maintenance & submission

References:

Unit 1: Anatomy and physiology of the auditory system

1. Gleeson, M. J., & Clarke, R. C. (2008). Scott-Brown's Otorhinolaryngology: Head and Neck Surgery 7th Ed: 3 volume set: CRC Press.
2. Dhingra, P.L (2013 Diseases of Ear, Nose and Throat. New Delhi: Elseveir
3. Blair, R and Maran A.D.G. (2001). Long Turners Diseases of Ear, Nose and Throat. Hodder Arnold
4. English, G.M. (1976). Otorhino-laryngology a text book. Michigan: Medical Department Harper and Row
5. Standring, S. (2008). Gray's Anatomy: The Anatomical Basis of Clinical Practice, Expert Consult. Livigstone: Churchill publishers.

Unit 2: Diseases of the external and middle ear

1. Gleeson, M. J., & Clarke, R. C. (2008). Scott-Brown's Otorhinolaryngology: Head and Neck Surgery 7th Ed: 3 volume set: CRC Press.
2. Dhingra, P.L (2013 Diseases of Ear, Nose and Throat. New Delhi: Elseveir
3. Blair, R and Maran A.D.G. (2001). Long Turners Diseases of Ear, Nose and Throat. Hodder Arnold
4. English, G.M. (1976). Otorhino-laryngology a text book. Michigan: Medical Department Harper and Row
5. Standring, S. (2008). Gray's Anatomy: The Anatomical Basis of Clinical Practice, Expert Consult. Livigstone: Churchill publishers.

Unit 3: Diseases of the cochlea

1. Gleeson, M. J., & Clarke, R. C. (2008). Scott-Brown's Otorhinolaryngology: Head and Neck Surgery 7th Ed: 3 volume set: CRC Press.
2. Dhingra, P.L (2013 Diseases of Ear, Nose and Throat. New Delhi: Elseveir
3. Blair, R and Maran A.D.G. (2001). Long Turners Diseases of Ear, Nose and Throat. Hodder Arnold
4. English, G.M. (1976). Otorhino-laryngology a text book. Michigan: Medical Department Harper and Row
5. Standring, S. (2008). Gray's Anatomy: The Anatomical Basis of Clinical Practice, Expert Consult. Livigstone: Churchill publishers.

Unit 4: Vestibular system

1. Weber, P.C. (2008). Vertigo and Disequilibrium: A Practical Guide to Diagnosis and Management. Thieme
2. Biswas, A. (2005). Introduction to Neurotology. Mumbai: Bhalani Medical book house

Paper Code: AUD 1.5 b - SC: Clinical Counselling

Objectives:

After successful completion of the course student will be

1. Prepare in the specific area of clinical counselling to understand counsellor-client relationships in the context of training and rehabilitation of individuals with communication disorders.
2. Trained in practical skills and competencies required for mastering basics of clinical counselling for identification and management of persons with communication disorders.
3. Sensitized on the ethical aspects of clinical counselling.
4. Able to integrating counselling based aspects in the field of research in communication disorders.

Unit 1: Introduction **18 Hrs**

- 1.1 Guidance and Counselling: Meaning, Nature, Scope, Principles and Goals
- 1.2 Types and Techniques: Individual and group with special focus on need and applications of clinical counselling
- 1.3 Counselling across life span: Child, Adolescent, Parenthood, Sibling, Grandparent/Elderly;
- 1.4 Counselling across Relationships: Teacher, family and peer Group

Unit 2: Counsellor qualities **18 Hrs**

- 2.1 Portrait of Effective Counsellors: Qualifications and Qualities, Micro and macro skills and competencies
- 2.2 Do's and Don'ts; Expectations and Limitations in Professional Clinical Counselling
- 2.3 Tips for Improvement
- 2.4 Ethical Issues

Unit 3: Counselling process **18 Hrs**

- 3.1 Counselling Process: Stages in Clinical Counselling
- 3.2 Preparation and Pre-requisites: Middle Phase, Termination
- 3.3 Therapeutic Relationships
- 3.4 Principles in Clinical Practice: Directive and Non-Directive approaches

3.5 Tools for Clinical Counselling

3.6 Major Events (Transference, Counter Transference & Resistance)

Unit 4: Special areas 18 Hrs

4.1 Special Areas in clinical counselling: Counselling the differently abled, parents, sibling and grandparents and significant others

4.2 Counselling: Crisis counselling, gender counselling, human rights,

4.3 Enablement and empowerment through counselling

4.4 Counselling the elderly & psychiatric patients

Practicum:

1. Direct observation and thematic recording of at least two sessions of professional individual counselling.
2. Notes taking of group counselling session.
3. Eliciting counselling needs of target groups.

Reference:

Title: Fundamentals of Clinical Counselling

Unit 1: Introduction

1. Gelso, C.J., & Fretz, B.R. (1995). *Counselling Psychology*. New Delhi: A Prism Indian Edition.
2. Hansen, J.C., Stevic, R.R., & Warner, R.W. (1987). *Counselling*. Boston: Allyn & Bacon, Inc.,
3. Nelson-Jones, R. (1999). *Introduction to Counselling Skills*. London: Sage Publications.
4. Rao, N.S. (1981). *Counselling Psychology*. New Delhi: Tata McGraw Hill Pub. Co.
5. Palmer, S., Dainow, S., & Milner, P. (1996). *Counselling*. London, Sage Pubs.
6. Shertzer, B.S., & Stone, B. (1968). *Fundamentals of Counselling*. NY: Houghton Mifflin Co.
7. Neukrug, E. (2015). *The world of counsellor: an introduction to counselling profession*. Boston: Cengage Learning.
8. Capuzzi, D., & Gross, D.R. (Eds.). (2013). *Introduction to counselling program*. New York: Routledge.

Unit 2: Counsellor qualities

1. Street, E. (1994). *Counselling for Family Problems*. London, Sage Publications.
2. Blackham, G.J. (1977). *Counselling – Theory, Process & Practice*. Belmont: Wadsworth.
3. Palmer, S. (1999). *Introduction to Counselling and Psychotherapy*. London: Sage Publications.
4. Corey, G. (2011). *Theory and practice of group counselling*. 8th Edition. California: Brooks/Cole Publishing Company.
5. Corey, G. (2001). *The art of integrative counselling*. Pacific Grove, CA: Brooks/Cole.
6. Gladding, S.T. (2009). *Counselling: a comprehensive profession*. New Delhi: Dorling Kindersley (India) Limited.
7. Corey, G. (2013). *Student manual for Corey's theory and practice of counselling and psychotherapy*. Boston: Cengage Learning.

Unit 3: Counselling process

1. Nelson-Jones, R. (1982). *The Theory and Practice of Counselling Psychology*. London: Holt, Rinehart and Wilson.
2. Corey, G. (2008). *Theory and practice of counselling and psychotherapy*. California: Brooks/Cole.
3. Corey, G., Corey, C., & Corey, M.S. (2008). *Groups: Process and Practice*. California: Brooks/Cole.
4. Woolfe, R., Strawbridge, S., Douglas, B., & Dryden, W. (2010). *Handbook of counselling psychology*. New Delhi: Sage Publications.
5. Daley, D.C., & Zuckoff, A. (1999). *Improving treatment compliance: counselling and systems strategies for substance abuse and dual disorders*. Minnesota: Hazelden.
6. Welfel, E.R. (2004). *The counselling process: a multi-theoretical integrative approach*. Pacific Grove, CA: Thomas/Brooks/Cole.
7. Bradley, L.J., & Ladany, N. (2001). *Counsellor supervision: principles, process, and practice*. Philadelphia: Brunner-Routledge.

Unit 4: Special areas

1. Jacobs, Ed. E., Masson, R.L., & Harvill, R.L. (1998). *Group Counselling: Strategies & Skills*. Pacific grove, CA: Books/Cole Pub. Co.,
2. Madden, G.R. (1998). *Legal Issues in Social Work: Counselling and Mental Health*. Thousand Oaks: Sage.
3. Thomas, R.M. (1990). *Counselling and Life-span development*. New Delhi: Sage.
4. Tudor, K. (1998). *Group Counselling*. London: Sage.

5. *Hart, JT (1983). Modern eclectic therapy a functional orientation to counselling and psychotherapy. New York: Plenum.*
6. *Maki, D.R., & Tarvydas, V.M. (2011). The professional practice of rehabilitation counselling. New York: Springer.*
7. *Toporek, L., Gerstein, L., Fouad, N., Roysircar, G., & Isreal, T. (2006). Handbook of social justice in counselling psychology. New Delhi: Sage.*
8. *Gazda, G.M. (1989). Group Counselling. Boston: Allyn & Bacon.*
9. *Ivey, A.E. (1998). Intentional interviewing and counselling: facilitating client development in a multicultural society. New York: Wadsworth.*

Paper Code: AUD 1.6 - HCC: Clinical Practicum I

II SEMESTER

Paper Code: AUD 2.1 - HC: Psychophysics of Audition

Objectives:

After completion of the course, the student should be able to:

1. Explain the basis of auditory object perception.
2. Explain the influence of stimulus on auditory system with reference to adaptation and fatigue.
3. Understand and describe different aspects of auditory space perception.
4. Clinically implement the concept of binaural hearing in audiological assessment and management.

Unit 1: Auditory scene analysis 18 Hrs

- 1.1 Auditory object perception in individuals with normal hearing and those with hearing impairment
 - Basic concepts in auditory object perception
 - Spectral cues for object perception
 - Spectral separation
 - Spectral profile analysis
 - Temporal cues for object perception
 - Temporal separation
 - Harmonicity/Temporal regularity
 - Temporal onset and offset
- 1.2 Auditory pattern perception in individuals with normal hearing and those with hearing impairment
 - Timber perception
 - Time invariant-pattern and time varying pattern perception

**Unit 2: Space perception in individuals with normal hearing and those with hearing impairment
18 Hrs**

- 2.1 Localization of pure-tones
 - Cues for localization
 - Cone of confusion
 - Time-intensity trading
- 2.2 Localization of complex tones
 - Cues for localization
 - Acuity of lateralizing transients
 - Acuity as a function of frequency and use of envelope
 - Onset disparities vs. ongoing disparities
 - Time-intensity trading

Unit 3: Binaural hearing in individuals with normal hearing and those with hearing impairment
18 Hrs

3.1 Models of binaural hearing in normal hearing individuals

3.2 Binaural hearing

- Binaural Squelch effect
- Sluggishness of binaural system
- Binaural fusion of pulsed stimuli
- Binaural beats
- Binaural interference
- JND for dichotic phase

3.3 Masking level difference

- Pure tones
- Complex signals

Unit 4: Auditory adaptation in individuals with normal hearing and those with hearing impairment
18 Hrs

4.1 Adaptation vs. fatigue

4.2 Methods of studying adaptation

4.3 Binaural adaptation

4.4 Neurophysiological basis of adaptation

4.5 Factors affect adaptation

- Subject
- Stimulus
- Procedural

Practicum:

Psychoacoustic Practicum

1. Measuring binaural fusion for pulsed stimuli on 3 individuals with normal hearing.
2. Measuring JND for dichotic phase on 3 individuals with normal hearing.
3. Measuring masking level difference for pure-tone and complex signals on 3 individuals each with normal hearing

References:

Unit 1: Auditory scene analysis

1. Bregman, A. S. (1994). Auditory Scene Analysis. The Perceptual Organization of Sound: MIT Press.
2. Gelfand, S.A. (2004). Hearing. An introduction to psychological and physiological acoustics. 4th Edn. New York: Marcel Dekker.
3. Moore, B. C. J. (1995). Hearing, San Diego: Academic Press.
4. Moore, B. C. J. (1997). Introduction to psychology of hearing. San Diego: Academic Press.
5. Moore, B. C. J. (2008). Cochlear hearing loss: physiological, psycho-logical and technical issues. 2nd Ed. Wiley-Blackwell.
6. Pillow, J. (2009). Hearing in the Environment: Perception (PSY 323). Austin: The University of Texas.
7. Warren, R. M. (2008). Auditory Perception: An Analysis and Synthesis. Cambridge: Cambridge University Press.
8. Yost, W. A. (1994). Fundamentals of hearing (all editions). CA: Academic Press Inc.

Unit 2: Space perception in individuals with normal hearing and those with hearing impairment

1. Gelfand, S, A. (2005). Introduction to psychological and physiological acoustics. NY: Marcel Dekker.
2. Gullick, W. L., Gescheider, G. A., & Frisina, R. D. (1989). Hearing: Physiology Acoustics, Neural Coding & Psychoacoustics. OUP USA.
3. Moore, B. C. J. (1995). Hearing. San Diego: Academic Press.
4. Moore, B. C. J. (1997). Introduction to psychology of hearing, San Diego: Academic Press.
5. Pickles, J.O. (2008). Introduction to Physiology of Hearing. New York: Academic Press.
6. Tobias, V. J. (1970). Foundation of Modern Auditory Theory, San Francisco: Academic Press.
7. Warren, R. M. (2008). Auditory Perception: An Analysis and Synthesis. Cambridge: Cambridge University Press.
8. Yost, W. A. (1994). Fundamentals of hearing: An introduction. San Diego, Academic Press.
9. Yost, W. A., & Gourevitch, G. (1987). Directional Hearing, New York: Springer-Verlag.

Unit 3: Binaural hearing in individuals with normal hearing and those with hearing impairment

1. Gelfand, S.A. (2004). Hearing. An introduction to psychological and physiological acoustics. 4th Edn. New York: Marcel Dekker.
2. Jerger, J. (1973). Modern developments in Audiology. 2nd Edn. New York. Academic Press.

3. Loven, F. (2009). Introduction to normal auditory perception. Singapore: Delmar Cengage Learning.
4. Rosen, S., & Howell, D. (1991). Signals and systems for speech and hearing. CA: Academic Press Inc.
5. Tobias, J. V. (1970). Foundation of modern auditory theory. Volume I. New York: Academic Press.

Unit 4: Auditory adaptation in individuals with normal hearing and those with hearing impairment

1. Gelfand, S. A. (2004). Hearing. An introduction to psychological and physiological acoustics. 4th Edn. New York: Marcel Dekker.
2. Jerger, J. (1973). Modern developments in Audiology. 2nd Edn. New York: Academic Press.
3. Loven, F. (2009). Introduction to normal auditory perception. Singapore: Delmar Cengage Learning.
4. Rosen, S., & Howell, D. (1991). Signals and systems for speech and hearing. CA: Academic Press Inc.
5. Tobias, J. V. (1970). Foundation of modern auditory theory. Volume I. New York: Academic Press.
6. Tobias, J. V. (1983). Foundations of modern auditory theory. Vol. II, New York: Academic Press.
7. Yost, A. W., Popper A. N., & Fay, R. R. (2008). Auditory Perception of Sound Sources. Chicago: Springer-Verlag.
8. Yost, W. A. (1994). Fundamentals of hearing (all editions). CA: Academic Press Inc.

Paper Code: AUD 2.2 - HC: Electrophysiological Assessment of the Auditory System

Objectives

After completion of this course, students should be able to

1. Describe different auditory evoked potentials (AEPs), **their clinical applications and generators sites.**
2. Describe general principles in recording various AEPs
3. Independently decide the need for recording a particular AEP in a clinical set-up.
4. Independently set the parameters for recording and analyzing various AEPs.

Unit 1: General principle in recording of AEPs

18 Hrs

- 1.1 Stimuli for recording AEPs.
- 1.2 Acquisition of EEG signal
 - Common mode rejection
 - A/D conversion
 - Amplification
 - Antialiasing filter
 - Dipole orientation and scalp distribution
- 1.3 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
- 1.4 Rationale for nomenclature and generators of auditory evoked potentials

Unit 2 Early potentials

18 Hrs

- 2.1 Electro-cochleography: Acquisition, analysis and application of
 - Cochlear microphonics
 - Summating potentials
 - Action potentials
- 2.2 Auditory Brainstem Responses: Acquisition, analysis and application of
 - Frequency specific ABRs using tone burst, chirp and masking methods
 - Complex ABRs
 - Stacked ABR

Unit 3 Middle and late AEPs 18 Hrs

- 3.1 Factors affecting MLR & LLR
 - Stimulus
 - Acquisition
 - Subject
- 3.2 Clinical application of MLR and LLR
- 3.3 Acoustic change complex: Acquisition, analysis and application
- 3.4 Frequency following responses: Acquisition, analysis and application
- 3.5 Auditory steady state responses: Acquisition, analysis and application
- 3.6 VEMP & PAM : Acquisition, analysis and application

Unit 4 Endogenous potentials 18 Hrs

- 4.1 Overview of endogenous potentials
- 4.2 Acquisition, analysis, factors affecting and application of
 - MMN
 - P₃₀₀
 - N₄₀₀
 - P₆₀₀
 - ELAN
 - CNV
 - Other endogenous potentials
- 4.3 Multi-modality stimulation
- 4.4 Special techniques involved in acquisition and analysis of endogenous potentials

Practicum:

1. Calibrating the transient stimuli used for ABR using objective and , MLR and LLR using objective and subjective methods
2. Recording Auditory Brainstem Responses to click, tone burst, chirp and speech stimuli and observing the effect of stimulus and acquisition parameters on the latency, amplitude and morphology of the responses.
3. Practicing diagnostic tests using Auditory brainstem responses, like hearing threshold estimation, site-of-lesion testing, cochlear hydrops analysis masking procedure and stacked ABR.
4. Recording the Auditory Middle latency responses and long latency responses to click, tone burst and speech stimuli, and observing the effects of stimulus and acquisition parameters on the latency, amplitude and morphology of the responses.
5. Recording the P300 and mismatch negativity to frequency, intensity and duration deviance in pure tones, and place manner and voicing contrasts in consonant

(stop) vowel combinations. Estimating hearing threshold using ABR, MLR and LLR on 5 children with normal hearing, 5 children with hearing loss, 5 adults with normal and 5 adults with hearing loss.

References:

Unit 1: General principle in recording of AEPs

1. Burkard, R.F., Don, M., & Eggermont, J.J. (Eds.) (2007). Auditory Evoked Potentials: Basic Principles & Applications. Baltimore: Lippincott Williams & Wilkins.
2. Ferraro, J.A. (1997). Laboratory exercises in auditory evoked potentials. San Diego: Singular Publishing Group Inc.
3. Picton, T. (2010). Human Auditory Evoked Potentials. San Diego: Plural Publishing.
4. Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson.
5. Katz, J. (Ed.). (1994). Handbook of Clinical Audiology. Baltimore: Williams and Wilkins.
6. Roser, R.R., Valente, M., & Hosford-Dunn, D. (Eds.) (2000). Audiology: Diagnosis. New York: Thieme Medical Publishers.

Unit 2: Early potentials

1. Burkard, R.F., Don, M., & Eggermont, J.J. (Eds.) (2007). Auditory Evoked Potentials: Basic Principles & Applications. Baltimore: Lippincott Williams & Wilkins.
2. Hall, J.W. (1992). Handbook of Auditory Evoked Responses. Massachusetts: Allyn and Bacon.
3. Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson
4. Hall, J.W., & Mueller, H.G. (1997) Audiologists' Desk Reference. Volume 1: Diagnostic Audiology Principles, Procedures and Protocols. San Diego: Singular Publishing Group.
5. Hood, L.J. (1998). Clinical applications of auditory brainstem response. San Diego: Singular Publishing Group Inc.
6. Roser, R.R., Valente, M., & Hosford-Dunn, D. (Eds.) (2000). Audiology: Diagnosis. New York: Thieme Medical Publishers.
7. Sininger, Y., & Starr, A. (2001). Auditory neuropathy: A new perspective on hearing disorders. Singular Publications.
8. Picton, T. (2010). Human Auditory Evoked Potentials. San Diego: Plural Publishing Group.

Unit 3: Middle and late AEPs

1. Burkard, R.F., Don, M., & Eggermont, J.J. (Eds.) (2007). Auditory Evoked Potentials: Basic Principles & Applications. Baltimore: Lippincott Williams & Wilkins.
2. Hall, J.W. (1992). Handbook of Auditory Evoked Responses. Massachusetts: Allyn and Bacon.
3. Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson.
4. McPherson, L.D. (1995). Late potentials of the auditory system. London: Singular Publishing Group.
5. Roser, R.R., Valente, M., & Hosford-Dunn, D. (Eds.) (2000). Audiology: Diagnosis. New York: Thieme Medical Publishers.
7. McPherson, L.D. (1995). Late potentials of the auditory system. London: Singular Publishing Group.
8. Picton, T. (2010). Human Auditory Evoked Potentials. San Diego: Plural Publishing Group.

Unit 4: Endogenous potentials

1. Burkard, R.F., Don, M., & Eggermont, J.J. (Eds.) (2007). Auditory Evoked Potentials: Basic Principles & Applications. Baltimore: Lippincott Williams & Wilkins.
2. Hall, J.W. (1992). Handbook of Auditory Evoked Responses. Massachusetts: Allyn and Bacon.
3. Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson.
4. Katz, J. (Ed.). (1994). Handbook of Clinical Audiology. Baltimore: Williams and Wilkins.
5. McPherson, L.D. (1995). Late potentials of the auditory system. London: Singular Publishing Group.
6. Roser, R.R., Valente, M., & Hosford-Dunn, D. (Eds.) (2000). Audiology: Diagnosis. New York: Thieme Medical Publishers.
7. Picton, T. (2010). Human Auditory Evoked Potentials. San Diego: Plural Publishing Group.

Paper Code: AUD 2.3 a - SC: Neurophysiology of Hearing

Objectives:

After going through this course, the student shall be able to describe:

1. The different parts of auditory afferent and efferent systems
2. The functioning of auditory afferent and efferent systems
3. The methods used in auditory neurophysiology
4. Physiological basis of electrophysiological tests used for hearing assessment
5. The neurophysiological basis of clinical interpretation

Unit 1: Anatomy & physiology of the auditory nerve 18 Hrs

- 1.1 Structure and tonotopic organization of auditory nerve
- 1.2 Electrophysiology - Action potential, generation and properties.
- 1.3 Physiology of the auditory nerve
 - Stimulus coding - frequency, intensity and temporal coding.
 - Coding of complex signal at the auditory nerve
 - Non-linearity seen at auditory nerve.
- 1.4 Synapse
 - Neuro-transmitters vs. neuro- modulator
 - Properties and function of neuro-transmitter
 - Afferent and efferent neuro-transmitters
- 1.5 Application of knowledge of auditory nerve physiology in understanding various auditory nerve disorders

Unit 2: Central auditory pathway 18 Hrs

- 2.1 Anatomy of the ascending auditory pathway
 - Cochlear nucleus
 - Superior olivary complex
 - Lateral lemniscus
 - Inferior colliculus
 - Medial geniculate body
 - Tonotopic organization at the different levels.
- 2.2 *Physiology of the ascending auditory pathway*
 - Physiology of the cochlear nucleus
 - Physiology of superior olivary complex
 - Physiology of lateral lemniscus
 - Physiology of inferior colliculus
 - Physiology of medial geniculate body

- Coding of simple and complex acoustic signal at various sub cortical levels

Unit 3: Auditory cortex 18 Hrs

- 3.1 Anatomy and tonotopic organization of the primary and secondary auditory area.
- 3.2 Classifications of the auditory cortex
- 3.3 Neurobiological relationship between auditory cortex and other areas
- 3.4 Neurophysiology of the auditory area.
 - Coding of the stimulus parameters.
 - Coding of the complex acoustic signal
 - Plasticity of the auditory system
- 3.5 Coding of speech in auditory system
- 3.6 Physiology of sound localization in the auditory system

**Unit 4: Anatomy & physiology of the efferent pathway & cranial nerves related to ear
18 Hrs**

- 4.1 Anatomy of the efferent auditory system
 - Courses and distribution of MSOC in the cochlea
 - Courses and distribution of LSOC in the cochlea
 - Anatomy of the thalamic & upper brainstem efferent auditory system
- 4.2 Physiology of the auditory efferent system
 - Effect of auditory efferent system on physiology of cochlear nucleus, auditory nerve and cochlea
 - Role of auditory efferent system in perception of auditory stimuli.
 - Protective function of auditory efferent system
- 4.3 Anatomy of non-classical auditory pathway
- 4.4 Anatomy of the other cranial nerves related to ear.

Practicum:

Observe specimens of various auditory structures and make notes of observations

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Unit 2: Central auditory pathway

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Unit 3: Auditory cortex

18 Hrs

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Paper Code: AUD 2.3 b SC: Speech Production

Objectives

1. After completing this course, the student shall be able to:
2. Describe the Physiology of Speech Production
3. Discuss the Acoustic Theories
4. Describe the Acoustic Characteristics of Various Speech Sounds
5. Know the Application of Acoustic Analysis and Speech Synthesis

Unit 1: Introduction to the study of speech physiology

18 Hrs

- 1.1 The physiological aspects of speech production (respiration, laryngeal and articulatory subsystem)
- 1.2 Aerodynamics of speech
 - Mechanics of airflow: Laminar, orifice and turbulent flow
 - Generation of pressure in the respiratory system: Resting level, relaxation pressure curve
 - Maintenance of airway pressure for speech: Elastic recoil, sub glottal pressure for speech.
- 1.3 Speech breathing
- 1.4 Measures of respiratory analysis and instrumentation:
 - Air volume
 - Air flow
 - Air pressure measurements including intraoral and sub glottal pressure
 - Instruments for respiratory analysis

Unit 2: Theories and instrumentation in speech production

18 Hrs

- 2.1 Acoustic theory of speech production:
 - Source, types and its characteristics
 - Filter / transfer function and its characteristics
 - Output speech and its characteristics
 - Cavity volume and resonance relationship
 - Critical evaluation of acoustic theory of speech production
- 2.2 Fundamental aspects of speech acoustics
 - Acoustic wave
 - Analog and digital signal
 - Digitization
 - Analog-to-digital conversion
 - Sampling

- Quantization
- Bandwidth
- Frequency resolution
- Window
- Block duration
- Pre-emphasis
- Filtering
- Block shift

2.3 Acoustic analysis of speech

- Digital signal processing [waveform analysis, fast fourier transformation (FFT) and linear prediction correlation (LPC), pitch extraction, auto correlation, digital spectrogram, inverse filtering, long term average spectrum (LTAS), cepstrum]

2.4 Data acquisition systems- acoustic analysis softwares

- Format analysis
- Formant tracking
- F0 and intensity analysis
- Computerized Speech Lab (CSL)
- PRAAT

Unit 3: Acoustic characteristics of speech sounds and spectrography 18 Hrs

3.1 Spectrogram

- Spectrograms of vowels and consonants
- Identifying place of articulation, manner of articulation, voicing and aspiration
- Identification of vowels, syllables, words, word boundaries and sentences

3.2 Acoustic characteristics of vowels and diphthongs

- Vowel classification
- Vowel formant pattern
- Vowel short-term spectrum
- Vowel duration
- Vowel fundamental frequency
- Formant bandwidth and amplitude on glide and off glide of formants

3.3 Acoustic characteristics of plosives

- Vocal tract configuration
- Five distinct characteristics of Plosives
- Closure duration
- Release burst
- Release burst spectrum
- Release burst amplitude
- Friction and aspiration
- Voice onset time
- Formant transitions
- Voicing characteristics

3.4 Acoustic characteristics of nasal consonants

- Vowel tract configuration
- Formant frequencies
- Nasal murmur
- Formant damping
- Bandwidth
- Formant transitions
- Antiformants

3.5 Acoustic characteristics of fricatives

- Vocal tract configuration
- Classification of fricatives
- Acoustic characteristics of stridents and non-stridents

3.6 Acoustic characteristics of other consonants

- Affricates: Vocal tract configuration, acoustic differences between affricates and plosives
- Glides: Vocal tract configuration, formants, and transitions
- Liquids: Vocal tract configuration, formants, anti formants and transitions.

Unit 4: Application of acoustic analysis and speech synthesis 18 Hrs

4.1 Applications of acoustic analysis in speech disorders: speech of persons with hearing impairment, stuttering, dysarthria, cleft lip and palate

4.4 Speech Synthesis:

- Types: Articulatory synthesis, parametric synthesis and analysis by synthesis
- Applications of speech synthesis

Practicum:

- Measurement of aerodynamic parameters using spirometer and aeroview
- Practical on fft, lpc, cepstrum and inverse filtering
- Acoustic analysis of vowels, diphthongs, plosives, nasals, fricatives, affricates and other speech sounds using spectrograms on PRAAT
- Vowel synthesis using parametric and analysis by synthesis
- Demonstration of articulatory synthesis

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Unit 3: Acoustic characteristics of speech sounds and spectrography

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Unit 4: Application of acoustic analysis and speech synthesis

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2. Journal of Logopedics Phoniatrics & Vocology,
3. Folia Phoniatica
4. Phonetica
5. Phonology
6. Journal of Phonetics
7. Journal of Speech Production
8. Journal of Speech, Language, and Hearing Research
9. Journal of All India Institute of Speech and Hearing
10. Journal of Indian Speech and Hearing Association
11. Speech Communication
12. Speech Language and Hearing

Paper Code: AUD 2.4 a - SC: Age related changes in Audio-Vestibular System

Objectives:

After successful completion of this course, the student should be able to

1. Explain the age-related changes in peripheral, central auditory and vestibular systems.
2. Modify tests and interpret their outcomes taking into account an individual's age

Unit 1: Anatomical and physiological changes in the audio-vestibular system from embryonic stages onwards. 18 Hrs

1.1 Conductive mechanism

- External ear (pinna, external auditory meatus and tympanic membrane)
- Middle ear

1.2 Cochlea

- Hair cells
- Stria vascularis
- Basilar membrane properties
- Transduction properties
- Other structures

1.3 Peripheral vestibular system

- Semi-circular canals
- Otolith organs (Utricle & Saccule)

1.4 Age at which maturation is attained and age at which decline commences for:

- Conductive mechanism
- Cochlea
- Peripheral vestibular system

Unit 2: Anatomical and physiological changes in audio-vestibular nervous system from embryonic stages onwards. 18 Hrs

2.1 Auditory nervous system

- Auditory nerve
- Other structures such as cochlear nucleus, SOC, lateral lemniscus, inferior colliculus, auditory thalamus and auditory cortex

2.2 Vestibular nervous system

- Vestibular nerve
- Vestibular nucleus
- Other structures: cerebellum, vestibular cortex
- VOR and VSR reflex pathways

2.3 Neurotransmitter properties and changes in various neuro-transmitters due to ageing

2.4 Age at which maturation is attained and age at which decline commences for:

- Auditory nervous system
- Vestibular nervous system

Unit 3: Effect of age on behavioural auditory and vestibular responses 18 Hrs

3.1 Tests of auditory function

- Psychophysical measures
 - Absolute thresholds
 - Difference limens for intensity, frequency and duration
 - Loudness
 - Pitch
- Central auditory processes
 - Temporal processing
 - Binaural integration
 - Binaural interaction
 - Localization/Lateralization
 - Binaural separation
 - Auditory closure

3.2 Tests for vestibular function

- Romberg test
- Fukuda stepping test
- Tandem gait test
- Doam and foam test
- Past pointing test (finger-to-noise test)
- Subjective visual vertical

Unit 4: Effect of age on physiological responses of auditory and vestibular systems 18 Hrs

4.1 Physiological assessment of auditory system

- Tympanometry and reflexometry
- Otoacoustic emissions (TEOAE, DPOAE and fine structure)

4.2 Electrophysiological assessment of auditory system

- Auditory brainstem responses to speech and non-speech stimuli
- Auditory middle latency responses
- Auditory late latency responses to speech and non-speech stimuli
- Other event related potentials – MMN, P₃₀₀.

4.3 Vestibular electrophysiological changes

- Vestibular evoked myogenic potentials
 - Cervical VEMP
 - Ocular VEMP
- Oculomotor evaluation
 - Gaze test

- Optokinetic test
- Smooth pursuit test
- Saccade test
- Positional and positioning test
- Video head impulse test
- Bithermal caloric test
- Computerized dynamic posturography
- Rotary chair test

PRACTICUM:

1. Collect and watch videos and slides showing embryological developmental, maturation and ageing associated changes in the audio-vestibular system; explain the changes observed.
2. Make separate test protocols for auditory and vestibular system assessment for infants, toddlers, and older adults.

References:

Unit-1: Anatomical and physiological changes in the audio-vestibular system from embryonic stages onwards.

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Unit-3: Effect of age on behavioural auditory and vestibular responses

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Unit-4: Effect of age on physiological responses of auditory and vestibular systems

1. Anderson, S., Parbery-Clark, A., Yi, H. G., & Kraus, N. (2011). A neural basis of speech-in-noise perception in older adults. *Ear and Hearing*, 32(6), 750-757.
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11. Tremblay, K. L., Piskosz, M., & Souza, P. (2003). Effects of age and age-related hearing loss on the neural representation of speech cues. *Clinical Neurophysiology*, 114(7), 1332-1343.

Paper Code: AUD 2.5 b - SC: *Clinical Behaviour analysis*

Objectives

After successful completion of the course student will be:

- Prepared in the specific area of clinical behavior analysis, therapy or change programs for affected individuals with communication disorders.
- Trained in practical skills and competencies required for mastering basics of clinical behavior analysis in their practice for identification and management of persons with communication disorders
- Sensitized on the ethical aspects of clinical behavior analysis when dealing with individuals or their families with communication disorders.
- Able to integrate clinical behavior analysis and counselling based aspects in the field of research in communication disorders.

Unit 1: Introduction 18 Hrs

- 1.1 Learning: Meaning and Types
- 1.2 Behavioral Perspectives: History to current trends in Behavior Medicine
- 1.3 Behavioral Theories. Pavlov: Skinner and Watson
- 1.4 Concept of Behavior Therapy and Behavior Modification
- 1.5 Behavioral Assessment: Meaning & Characteristics - Behavioral Perspective
- 1.6 Recent Variations: Applied Behavior Analysis and Dialectical Behavioral Counseling – ABC Model

Unit 2: Behavior assessment 18 Hrs

- 2.1 Behavior Assessment Scales: Western and Indian-AAMD Adaptive Behavior Scale, *PBCL*, BASIC-MR, ACPC-DD, MDPS, etc
- 2.2 Skills, Steps and Strategies: Procedure of Behavior Assessment & Management: Skill Training and Problem Behavior Remediation
- 2.3 Shaping, Chaining, Prompting, Fading, Modeling, Contingency Contracting, Reward Training, Token Economy, Activity Scheduling, Systematic Desensitization, Flooding, Aversion Techniques
- 2.4 Self Management Techniques: Correspondence Training

Unit 3: Behavior change techniques 18 Hrs

- 3.1 Behavior Change Techniques: Shaping, Chaining, Prompting, Compliance training, Stress Management/ Relaxation Techniques: JPMR, Yoga – Habit Reversal Techniques – Paradoxical Intention – Negative Practice
- 3.2 Operant Procedures and Techniques: Counter-Conditioning, Desensitization, Aversive Conditioning Procedures,
- 3.3 Self-control Procedures and Cognitive Procedures
- 3.4 Time Out, Over-correction

Unit 4: Allied behavioral procedures 18 Hrs

- 4.1 Biofeedback: EEG, EMG, GSR, EKG and Thermal – Polygraph;
- 4.2 Cognitive Behavior Techniques: Beck and Ellis – Reality Therapy and Transactional Techniques

Practicum:

- 1. Interviewing of parents for skill and problem behavior mapping.
- 2. Setting behavioural objectives for program planning.

References:

Unit 1: Introduction

- 1. Feldman, M.P., & Broadhurst, A. (1976). *Theoretical and experimental bases of the behavior therapy*. London: Wiley.
- 2. Housten, R.V., & Axelrod, S. (1993). *Behavior analysis and treatment*. New York: Springer.
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Unit 2: Behavior assessment

- 1. Ramnero, J., & Törneke, N. (2008). *ABCs of human behavior: Behavioral principles for the practicing clinician*. Oakland, CA: New Harbinger & Reno, NV: Context Press.
- 2. Miltenberger, R.G., (2008). *Behavior modification: Principles and procedures (4th Ed.)*. Pacific Grove, CA: Thomson/Wadsworth.
- 3. Woods, D. W., & Kanter, J. W. (Eds.). (2007). *Understanding behavior disorders: A contemporary behavioral perspective*. Reno, NV: Context Press.
- 4. Cooper, J.O., Heron, T.E. & Heward, W.L. (2007). *Applied Behavior Analysis (2nd Edition)*. Prentice Hall.
- 5. Baum, W. M. (2004). *Understanding Behaviorism: Behavior, Culture, and Evolution (2nd edition)*. Wiley-Blackwell.

6. Pierce, W.D. & Cheney, C.D. (2003). *Behavior Analysis and Learning*, 3rd edition. Lawrence Erlbaum.

Unit 3: Behavior change techniques

1. Baldwin, J.D., & Baldwin, J.I. (2000). *Behavior Principles in Everyday Life* (4th Edition). Prentice Hall.
2. Dougher, M. J. (Ed.). (2009). *Clinical Behavior Analysis*. Reno, NV: Context Press.
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7. Skinner, B.F. (1965). *Science and Human Behavior*. Free Press.

Unit 4: Allied behavioral procedures

1. Culbert, T.P. (1999). *Biofeedback with Children and Adolescents*. In *Innovative Psychotherapy Techniques in Child and Adolescent Therapy*. , Edited by C. Schaefer. New York: John Wiley.
2. Di Franco, J.T. (2000). *Biofeedback*. In *Childbirth Education: Practice, Research and Theory*, Edited by F. H. Nichols and S. S. Humenick. Philadelphia: W. B. Saunders.
3. Schwartz, M.S. (1987). *Biofeedback: A Practitioner's Guide*. New York: Guilford.
4. Spencer, J.W., & Jacobs, J.J. (1999). *Complementary/Alternative Medicine: An Evidence-Based Approach*. Baltimore: Mosby.
5. Stoyva, J.M., & Thomas H.B. (1993). *Biofeedback Methods in the Treatment of Anxiety and Stress Disorders*. In *Principles and Practice of Stress Management*. Edited by P. M. Lehrer and R. L. Woolfolk. New York: Guilford Press.

Paper Code: AUD 2.6 - HC: Clinical Practicum II

SEMESTER III

Paper Code: AUD 3.1 - HC: Implantable Devices for Individuals with Hearing Impairment

Objectives:

At the end of the course, the student shall be able to:

- Identify, describe the types of implantable hearing devices and describe the purpose(s) of each component used in implantable hearing devices.
- Select candidates for implantable hearing devices.
- Assess and counsel the benefit from implantable hearing devices.
- Suggest schemes / loans to obtain implantable hearing devices.

Unit 1: Partial and total implantable hearing aids

10 Hrs

1.1 Bone-conduction implantable devices

- Candidacy
- Components
- Overview to surgery
- Types bone conduction implantable devices (Percutaneous & Transcutaneous)

1.2 Middle ear implants

- Candidacy
- Components
- Overview to surgery

1.3 Types of middle ear implants

- Partial implantable and Totally implantable devices
- Electro-mechanical and piezo-electric

1.4 Evaluation of bone-conduction implantable devices & middle ear implants

- Pre-operative evaluation
- Fitting
- Assessment of benefits

1.5 Counselling regarding partial and total implantable hearing aids

- Care and maintenance
- Trouble shooting of the device

Unit 2: Cochlear implants 14 Hrs

- 2.1 Introduction to cochlear implants
 - Overview to development of cochlear implants
 - Overview to biological safety
 - Surgical procedures in brief
 - Complications and immunization
 - International and national regulations for implantable devices
- 2.2 Cochlear implant features
 - Types: Bilateral implants, hybrid implants, bimodal implants
 - Components
 - Coding strategies within and across companies
 - Device failure (hard and soft)
- 2.3 Candidacy
 - Non-audiological criteria
 - Audiological criteria
 - Role of team members in candidacy selection
 - Expansion of cochlear implant candidacy
- 2.4 Pre-operative evaluation for children and adults
 - Behavioural: Speech and non-speech
 - Objective: OAE, Immittance evaluation, Auditory evoked potentials including eABR
- 2.5 Counseling (pre-operative)
 - Realistic expectations; Predictors of benefit from cochlear implants including genetic predictors
 - Role of team
 - Loan, insurance
 - Pre-operative counseling; Procedure for obtaining consent
 - Contraindication for cochlear implants

Unit 3: Mapping / Programming 18 Hrs

- 3.1 Overview to Mapping / Programming
 - 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)
 - Map parameters: Pulse width, stimulation rate, maxima, frequency allocation and re-distribution ,
 - Mapping of those with malformations of the cochlea
 - Effect of map parameters on loudness and pitch perception
- 3.2 Mapping procedure
 - Mapping using behavioural measures
 - Mapping using objective measures (ECAP & ESRT)

3.3 Evaluations

- Assessment of benefit: Non-speech and speech tests
- Electrophysiological measures (EABR and other evoked potentials)
- Optimization of: Hearing aid in the contralateral ear for bimodal implants; Bilateral cochlear implants; Electroacoustic stimulation

3.4 Overview to psychophysics of perception through cochlear implants: Intensity discrimination, loudness perception, loudness growth, loudness adaptation, loudness summation, pitch discrimination, gap detection, frequency resolution, temporal integration, masking, binaural phenomenon.

3.5 Counseling (post-operative)

- Care and maintenance, trouble shooting
- Counseling regarding outcome measures and follow-up
- Counseling regarding importance of habilitation
- Warranty.

Unit 4: Brainstem implant, midbrain implants

4.1 Candidacy for Brainstem implant, Midbrain implants

- Non-audiological criteria
- Audiological criteria
- Surgical procedures in brief

4.2 Pre-operative evaluation for children and adults; ABI/MBI team

4.3 Components, types, features; Mapping procedure of Brainstem implants, Midbrain implants

4.4 Post implant evaluation and benefits from Brainstem implant, Midbrain implants

4.5 Future needs in implantable devices (implantable hearing aids, cochlear implants, brainstem implant, midbrain implants)

Practicum:

1. Observation of mapping and recording NRT in cochlear implantees and write an analytic report.
2. From 10 case files, make recommendations for further testing to decide candidacy for implantable devices.
3. Compile information from 10 case files of individuals with hearing impairment (5 children & 5 adults) and make recommendations whether implantable devices are to be recommended or not.
4. Simulate map parameters to increase 'C' / 'M' levels.
5. Compile map parameters of implantable devices available in India.

References:

Unit 1: Partial and total implantable hearing aids.

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Unit 2: Cochlear implants

1. Clark, G., (2003). Cochlear implants - fundamentals & Applications. New York: Springer – AIP Press.
2. Clark, G., Tong, Y.C., & Patrick, F.J. (1990). Cochlear Prostheses. Edinburgh London Melbourne & New York: Church Hill Living stone.
3. Clark, M.G., R.S.C. Cowan & Dowell. R.C. (1997). Cochlear implantation for infants & children-advances. London: Singular Publishing Groups.
4. Cooper, H. (1995). Cochlear Implants –A practical guide. Delhi: AITBS Publishers.
5. Cullington, H.E. (2004). Cochlear implants-objective measures. London: Whurr Publishers.
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12. Niparko, J. K. (2009). Cochlear Implants: Principles and practices. 2nd Edn. Philadelphia: Lippincott: Williams & Wilkins.
13. Ruckenstein, M. J. (2012). Cochlear implants and other implantable devices. San Diego: Plural publishing, Inc.
14. Tyler, R.S. (1995). Cochlear implants: Audiological foundations. New Delhi: AITBS Publishers.
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Unit 3: Mapping/Programming

1. Clark, G., Tong, Y.C., & Patrick, F.J. (1990). Cochlear Prostheses. Edinburgh London Melbourne & New York: Churchill Livingstone.
2. Clark, M.G., R.S.C. Cowan, & Dowell, R.C. (1997). Cochlear implantation for infants & children-advances. London: Singular Publishing Groups.
3. Cooper, H. (1995). Cochlear Implants –A practical guide. Delhi: AITBS Publishers.
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11. Wolfe, J., & Schafer, E. C. (2010). Programming Cochlear Implants. San Diego: Plural Publishing Inc.
12. Zeng, Popper & Fay (2004). Cochlear implants-Auditory Prostheses & Electric Hearing. New York: Springer-Verlag.

Unit 4: Brain implant, mid-brain implants

1. Allum, D.J., ((1996). Cochlear implant rehabilitation in children & Adults. London: Whurr Publishers Ltd.
2. Kim, C.S., Chang, S.O., & Lim, D. (2000). Updates in cochlear implantation. Switzerland: Karger.
3. Lim, H. H., Lenarz, M., & Lenarz, T., (2009). Auditory midbrain implant: A review. *Trends in Amplification*, Sept. 13(3), 149–180.

4. Clark, M.G., R.S.C. Cowan, & Dowell. R.C. (1997). Cochlear implantation for infants & children-advances. London: Singular Publishing Groups.
5. Cooper, H. (1995). Cochlear Implants –A practical guide. Delhi: AITBS Publishers.
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9. Tyler, R.S. (1995). Cochlear implant: Audiological foundations. New Delhi: AITBS Publishers.
10. Waltzman, S.B., & Cohen, N.L. (2000). Cochlear implants. New York: Thieme Medical Publishers.
11. Ladd, P. (2003). Understanding Deaf Culture. Great Britain: Cromwell Press Ltd.

Paper Code: AUD 3.2 - HC: Speech Perception

Objectives:

After completing this course, the candidate should be able to

1. Explain coding of speech in the auditory pathway in normal hearing individuals
2. Explain basic concepts regarding speech perception
3. Critically evaluate theories of speech perception and methods to synthesis speech
4. Describe the major and minor acoustic cues for speech perception in normal hearing individuals
5. Explain about speech perception in relation to short term memory
6. Describe aspects related to dichotic speech perception
7. Compare **adult**, infant and animal speech perception.

Unit 1: Introduction to and theories of speech perception

18 Hrs

1.1 Basic concepts.

- Differentiation of Hearing, Listening and Perception, Comprehension
- Overview on the acoustic cues of different classes of speech sounds

1.2 Categorical perception

- Definition
- Evidence for and against categorical and continuous speech perception

1.3 Normalization in speech perception

- Definition
- Methods used for normalization of vowels and consonants

1.4 Coding of speech in the auditory pathway

- Coding in the cochlea and auditory nerve
- Coding in the central auditory pathway

1.5 Theories of speech perception

- Acoustic theory
- Neurological theory
- Auditory theory
- Motor theory and its revisions
- Analysis-by-synthesis
- Dual stream theory
- Reverse hierarchy theory

Unit 2: Perceptual cues for vowels and consonants

18 Hrs

2.1 Perception of vowels and diphthongs in normals:

- Major and minor cues to identify vowels and diphthongs
- Major and minor cues to differentiate vowels from diphthongs

2.2 Perception of consonants in normals:

- Major and minor cues to identify place, manner and voicing in: Stops, Fricatives, Affricates, Nasals
- Major and minor cues to differentiate between Stops, Fricatives, Affricates, Nasals

- Acoustical parameters used to differentiate vowels from consonants

Unit 3: Speech synthesis, co-articulatory perception and perception of suprasegmentals
18 Hrs

3.1 Methods used to synthesize speech for perceptual experiment

- Pattern play-back
- Analysis by synthesis
- Parametric synthesis
- Articulatory synthesis

3.2 Effects of co-articulation on speech perception:

- Basic concepts in coarticulation and methods to study coarticulatory perception
- Perception of vowels from consonantal segmental cues
- Perception of consonants from vowel segmental cues

3.3 Perception of suprasegmental cues in normal hearing individuals

- Perception of stress,
- Perception of rhythm
- Perception of intonation

Unit 4: Factors related speech perception **18 Hrs**

4.1 Short term 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

4.2 Dichotic listening

- Factors affecting dichotic perception
- Stimulus parameters
- Procedure parameters
- Subject parameters

4.3 Infant perception

- Methods of studying infant speech perception
- Theories of infant speech perception: Universal theory, Attunement theory, Perceptual Learning theory, Maturation theory, perceptual magnetic theory
- Studies to support the theories
- Perception of consonants and vowels in infants
- Comparison of adult and infant perception

4.4 Animal speech perception

- Overview on methods to study animal speech perception
- Need to study animal
- Perception of consonants and vowels
- Categorical perception and normalization
- Animal Vs. human perception

Practicum:

1. Observe the spectra, waveforms and spectrograms of various vowels and consonants and note down your observations
2. Note down the difference in the perception of consonants/vowels are truncated from CVC or VCV
3. Synthesize stop consonants using analysis by synthesis, parametric synthesis and articulatory synthesis
4. Use synthesized VOT continuum and F2 transition continuum to study categorical perception using discrimination and identification tasks
5. Note down the cross linguistic differences in speech perception in at least two languages.
6. Test recency and precedence using words

Common Reference:

1. Ainsworth, W.A. (1976). Mechanism of speech recognition. International series in natural philosophy. Vol. 85, Oxford: Pergamon Press.
2. Berlin, C. (1984). Hearing science. California: College-Hill Press, Inc.
3. Border, G. J., & Harris, K. S. (1980). Speech sciences primer: physiology, acoustic and perception of speech. London: Williams and Wilkins.
4. Baddeley, A. D. (1986). *Working Memory*. Clarendon Press.
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6. Eggermont, J. J. (2001). Between sound and perception: reviewing the search for a neural code. *Hearing Research*, 157(1-2), 1–42.
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Unit 3: Speech synthesis, coarticulatory perception and perception of suprasegmentals

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Unit 4: Factors related speech perception

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Paper Code: AUD 3.3 - HC: Seminars in Assessment of Hearing Impairment

Objectives:

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

1. Sign and Symptoms related to various peripheral and central auditory disorders.
2. The test battery for differential diagnosis of various auditory disorders.
3. The relationship between histopathology of the disorder and audiological test findings.
4. The different non-audiological tests and their importance in diagnosis of various auditory disorders.
5. The findings, pathophysiology, probable cause and counsel regarding appropriate management options to the clients.

Unit 1: Correlation of audiological findings to histopathological findings in conductive hearing loss 18 Hrs

- 1.1 Disorders of pinna and external auditory canal
- 1.2 Disorders of tympanic membrane
- 1.3 Disorders of ossicular chain
- 1.4 Other disorders related to middle ear cavity including tumors of the middle ear

Unit 2: Audiological findings and its relationship to histopathological findings cochlear and retrocochlear pathologies 18 Hrs

- 2.1 Cochlear pathologies-Mineres disease, presbycusis, ototoxicity, noise induced hearing loss, sudden sensorineural hearing loss, systemic diseases, autoimmune disorders
- 2.2 Retrocochlear pathologies-Space occupying lesions, auditory nerve tumors, auditory neuropathy, Other demyelinating disorders

Unit 3: Assessment of hearing in individuals with co-existing conditions 18 Hrs

- 3.1 Assessment of auditory disorders in the special population such as
 - Deaf-blind
 - Intellectually challenged
 - Pervasive developmental disorders
 - Cerebral palsy
- 3.2 Assessment of patients with hyperacusis
 - Conditions/disorders in which it occurs
 - Tests and interpretation
 - Implications of the findings in rehabilitation
- 3.3 Assessment of patients with Vestibular problems
 - Condition/disorders in which it occurs
 - Tests, interpretation
 - Implications of findings in rehabilitation
- 3.4 Assessment of patients with Tinnitus
 - Condition associated with tinnitus

- Types of tinnitus
- Evaluation
- Implications of findings in rehabilitation

Unit 4: Genetic hearing loss and non-audiological evaluations 18 Hrs

4.1 Genetic hearing loss

- Basics of Genes and genetic hearing loss
- Audiological and non-audiological tests for identifying genetic hearing loss,
- Gene mapping, amniocentesis
- Gene therapy
- Genetic counselling

4.2 Non-audiological tests

- Clinical neurological examination
- X-rays
- CT Scan
- MRI
- FMRI
- PET
- SPECT

4.3 Lab tests for differential diagnosis of auditory disorders

Practicum:

1. Administration and interpretation of various audiological tests on individuals with simulated conductive pathology (2 participants).
2. Administration and Interpretation of various audiological tests on individuals with simulated cochlear pathology (2 participants).
3. Administration and Interpretation of various audiological tests on individuals with various retrocochlear pathology (5 participants).
4. Administration and Interpretation of various tests of Tinnitus in normal subjects (2 participants).
5. Administration and Interpretation of various vestibular tests on normal hearing individuals (2 participants).

Reference:

Unit 1: Correlation of audiological findings to histopathological findings in conductive hearing loss

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Unit 2: Audiological findings and Its relationship to histopathological findings cochlear and retrocochlear pathologies

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Unit 3: Assessment of hearing in individuals with co-existing conditions

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Unit 4: Genetic hearing loss and non-audiological evaluations

1. Kingsley, R.E. (1996). Concise text of neuro-science. Philadelphia: Williams and Wilkins.
2. Martini, A, et al. (Eds.) (1996) Genetics and Hearing impairment, London: Whurr Publishers.
3. Shprintzen, R.J. (1997). Genetic, Syndromes and communication disorders. San Diego: Singular Publishing Group Inc.
4. Willems P J. (2004). Genetic Hearing loss. USA: Marcel Deckeer Inc.
5. Dalebout S (2009). The Praeger Guide to Hearing and Hearing Loss.USA: Greenwood Publishing Corporation.
6. Toriello H V., & Smith S D. (2013). Hereditary Hearing Loss and Its Syndromes. United Kingdom: Oxford University Press.
7. Flexer C A (2008). Pediatric Audiology: Diagnosis, Technology, and Management. New York: Thieme Medical Publishers.

Paper Code: AUD 3.4 - HC: Seminars in Rehabilitative Audiology

Objectives:

At the end of the course, the student shall

1. Know about various types of recent devices and advances in technology with respect to amplification/assistive devices.
2. Know selection strategies and optimization of hearing aids, critically review selection procedures of the hearing device
3. Be able to prepare the programs and intervention strategies as per the different needs of the clients having different auditory disorders across different age groups
4. List specific needs and know psychosocial and communicative demands and strategies to solve these

Unit 1: Advances in hearing aid and hearing assistive technology 18 Hrs

- 1.1 Application of recent advances in hearing aids and hearing assistive technology (HAT)
 - Compression and expansion, directionality, advanced signal processing techniques including noise reduction algorithms, wireless technology, data logging, trainable hearing aids, occlusion reduction, application of nanotechnology in hearing aids, others
 - Speech cue enhancement – spectral shape, duration, intensity, enhancement of CVR, speech simplification, re-synthesis
 - Enhancement of perception through telephone/mobile phone
 - Techniques to control acoustic feedback, distortion, circuit noise.
 - Electromagnetic interference – measurement, solutions; techniques to improve compatibility of hearing aids with mobile phones
- 1.2 Application of LASER technology in ear mould production, ear mould modifications – physical and acoustic modification;
- 1.3 Electroacoustic measurement of hearing aids
 - Advanced methods in electro-acoustic measurements of hearing aids including directionality, group and phase delay, DNR algorithm, and ALDs
 - Variables affecting electroacoustic measurements
 - Comparison of International and Indian standards/legislations for hearing aids and ALDs.

Unit 2: Fitting of hearing aid and hearing assistive devices 18 Hrs

- 2.1 Selection, verification and validation of hearing aids and hearing assistive devices.
 - Pre-selection: Factors affecting pre-selection, assessment of listening needs of the individuals with hearing impairment
 - Critical analysis of hearing aid selection procedures: Prescriptive and comparative procedures
 - Objective procedures for hearing aid fitting (ABR, ALLR, ASSR and others)
 - Hearing aid programming and optimization

- Hearing aid verification using insertion gain measurements and sound field measurement including verification of advanced features
- Validation
- 2.2 Hearing aid fitting for children
 - Special considerations while fitting hearing aids for infants and children in terms of pre-selection, selection, verification (including advanced features) and validation
 - Different protocols used (Minnesota early hearing detection and intervention (EHDI) program, American Academy of Audiology clinical practice guidelines)
- 2.3 Hearing aid fitting considerations for older adults
- 2.4 Management of other hearing disorders
 - Sudden hearing loss, unilateral hearing loss
 - High frequency hearing loss
 - Cochlear dead region, auditory dysynchrony, management of auditory dysynchrony vs. CAPD
 - Cerumen management
- 2.5 Fitting of HATs
 - Pre-selection: Factors affecting pre-selection, assessment of needs for HAT
 - Selection, verification and validation of HATs for different age groups
- 2.6 Future trends in hearing aids and HATs: Technology and fitting strategies

Unit 3: Rehabilitation of individuals with hearing impairment 18 Hrs

- 3.1 Counselling the hearing aid and HAT users
 - Overview to counselling theories/techniques
 - Realistic expectations, adjusting to hearing device, other management options
 - Care and maintenance of HATs for individuals with different age groups
 - Trouble shooting and fine tuning/optimization of hearing aids and HAT
- 3.2 Management of children with hearing impairment
 - Criteria for selecting different auditory listening programs; using an eclectic approach in providing listening training; criteria for transition from one method to the other as a child grows
 - Adapting AVT techniques for Indian languages and late identified children
 - Providing group listening training activities for children having different listening skills
 - Selection of language for training based on native language and regional language
- 3.3 Rehabilitation of adults and older adults
 - Justification for providing auditory listening / speech reading training for older adults including auditory plasticity
 - Techniques for adults and older adults
 - Variables that affect the communication and the role of the communication partner
 - Planning training activities; assertiveness training
- 3.4 Measuring therapy outcome
 - Importance of outcome
 - Measurement of therapy outcome for different age groups

- Comparison of outcome across different methods of training

Unit 4: Rehabilitation of multiple handicapped and tinnitus 18 Hrs

4.1 Management of the children/adult with multiple handicapped

- Hearing aid fitting considerations, strategies used and the outcome with different strategies for individuals with hearing impairment with visual problems; cognitive problems; neuro-motor problems

4.2 Audiological management of tinnitus

- Models related to tinnitus management: patho-physiological and neurophysiological model
- Overview to non-audiological management techniques for tinnitus
- Audiological management techniques for those with normal hearing and different degrees of hearing loss (TRT, counselling, others) and their outcomes

4.3 Audiological management of hyperacusis

- Models related to hyperacusis management; overview to non-audiological management techniques for hyperacusis
- Audiological management techniques for normal hearing and different degrees of hearing loss and their outcomes

Practicum:

- To carry out electro-acoustic measurements of digital hearing aids including directionality, group and phase delay, DNR algorithms, and HATs; comparison of EAC across different standards and write down the observations (1 hearing aid).
- To program advanced features of recent digital hearing aids (2 hearing aids).
- To carry out insertion gain measurements and RECD measurements (2 individuals).
- To watch videos on AVT and discuss strategies used.
- To collect and observe the videos of counseling the patients with tinnitus and hyperacusis.

References:

Unit 1: Advances in hearing aid and hearing assistive technology

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Unit 2: Fitting of hearing aid and hearing assistive devices

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4. Metz, M. J. (2014). Sandlin's textbook of hearing aid amplification. 3rd edn. San Diego: Plural publishing Inc.
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8. Tye-Murray, N. (2009). Foundations of Aural rehabilitation- Children, Adults & Their family members. United States of America: Delmar, Cengage Learning.
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10. Valente, M., & Hosford-Dunn, H. (2000). Audiology Treatment. New York: Thieme Medical Publishers.

Unit 3: Rehabilitation of individuals with hearing impairment

1. Alpiner, J.G., & McCarthy, P.A. (2000). Rehabilitative Audiology-Children & Adults. United States of America: Lippincott Williams & Wilkins.
2. Cole, E.B., & Carol, F. (2007). Children with hearing loss- Developing Listening & Talking. United States of America: Plural Publishing Inc.

3. Estabrooks, W. (2006). Auditory Verbal Therapy & Practice. United States: Alexander Graham Bell Association for the Deaf and Hard of Hearing Inc.
4. Hogan, A. (2001). Hearing Rehabilitation for deafened adults. London & Philadelphia: Whurr Publishers.
5. Hull, R. H. (2014). Introduction to aural rehabilitation. 2nd edn. San Diego: Plural publishing Inc.
6. Johnson, C. E. (2012). Introduction to auditory rehabilitation: A contemporary issues approach. New Jersey: Pearson Education Inc.
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9. Montano, J. J. (2014). Adult aural rehabilitation. 2nd Edn. San Diego: Plural Publishing Inc.
10. Roeser, R.J., & Downs, M.P. (2004). Auditory disorders in school children. New York: Thieme Medical Publishers Inc.
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Unit 4: Rehabilitation of multiple handicapped and tinnitus

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2. Baguley, D. M., & Andersson, G. (2007). Hyperacusis: Mechanisms, Diagnosis and Therapies. San Diego: Plural Publishing Inc.
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14. Wong, L., & Hickson, L. (2012). Evidence-based practice in audiology: Evaluating interventions for children and adults with hearing impairment. San Diego: Plural Publishing Inc.

Paper Code: AUD 3.5 a - SC: Vestibular System: Assessment and Management

Objectives:

After passing this course, the student should be able to

1. Describe the anatomy and physiology of the human vestibular system
2. Perform the tests for vestibular assessment and interpret the results
3. Identify various vestibular pathologies and differentially diagnose one from the others
4. Carry-out vestibular rehabilitation and make appropriate referrals

**Unit 1: Anatomy & physiology of the systems involved in balance maintenance
12 Hrs**

- 1.1 Anatomy and physiology of peripheral vestibular system
 - Semicircular canals
 - Utricle
 - Sacculle
 - Vestibular nerve
- 1.2 Anatomy of the central vestibular pathway and its connections
 - Brainstem
 - Cerebellum
 - Vestibular cortex
- 1.3 Reflexes involving the vestibular system
 - Vestibulo-ocular reflex- pathways from each of the semicircular canals, cranial nerves involved (cranial nerves II, IV and V)
 - Vestibulo-spinal reflex
 - Sacculocollic reflex
- 1.4 Other systems involved in balance
 - Proprioceptive (somatosensory) system- location of various receptors, strategies used for maintaining balance like ankle, hip, and step strategies
 - Visual system: Various kinds of eye movements like gaze, saccade, optokinetic and pursuit
- 1.5 Association between vestibular system and cognition

Unit 2: Assessment of vestibular system 15 Hrs

- 2.1 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)
- 2.2 Behavioral tests for bedside assessment, and diagnosis- background, technique involved, interpretation and usefulness

- Romberg test
 - Fukuda stepping test
 - Tandem gait test
 - Past pointing test (Finger-to-nose test)
 - Tests for cerebellar function (Alternate pronation-supination of palm, tracking of shin bone by the heel, use of appropriate strategies to pick up objects)
 - Head impulse test
 - Head shake test
 - Glycerol test
- 2.3 Physiological/electrophysiological tests- background, technique involved, interpretation and usefulness
- Rotatory chair test (sinusoidal harmonic acceleration, visual-vestibular interaction tests, vestibular ocular reflex suppression test, step velocity test)
 - Craniocorpography
 - Computerized dynamic posturography
 - Ocular motility testing using ENG/VNG (gaze, optokinetic, saccade and pursuit)
 - Positional/positioning tests
 - Caloric test using ENG/VNG (monothermal, bithermal and Cobrax test; use of Alexander's law)
 - VEMP (cervical, ocular and other variants)
 - Sclera coil search test
 - Video head impulse test
 - Subjective visual vertical and horizontal tests
 - Vestibular autorotation test

Unit 3: Disorders of the vestibular system

15 Hrs

- 3.1 Diseases of the vestibular labyrinth
- Meniere's disease
 - Benign paroxysmal positional vertigo
 - Labyrinthitis
 - Perilymph fistula
 - Superior semicircular canal dehiscence
 - Diabetes mellitus
- 3.2 Diseases of the nerve
- Vestibular neuritis
 - Auditory neuropathy spectrum disorders
 - Vestibular schwannomas
 - Diabetes mellitus
- 3.3 Diseases of the central nervous system
- Generalized neuropathy involving multiple systems
 - Multiple sclerosis
 - Tumors of CP angle and other cranial tumors
 - Cerebro-vascular accidents involving vestibular cortex and cerebellum
 - Vertebro-basilar insufficiency

- Migraine
- Meningitis and encephalitis

3.4 Age-related degeneration

3.5 Vestibular disorders in children

Unit 4: Management of vestibular dysfunction

12 Hrs

4.1 Treatments for unilateral and bilateral vestibular loss

4.2 Medical and surgical management of vertigo

- Vestibular suppression
- Dietary modifications
- Surgeries

4.3 Non-medical management of vertigo

- Brandt-Daroff exercises for positional vertigo
- Repositioning maneuvers for BPPV (Epley maneuver, Semont liberatory maneuver, Canalith repositioning maneuver, Gans repositioning maneuvers, Barbeque roll maneuver, Appiani maneuver, Guffoni liberatory maneuver)
- Other vestibular rehabilitation exercises

4.4 Rehabilitation of children with disequilibrium

Practicum:

1. Watch videos and slides of vestibular system's anatomy and physiology.
2. Perform behavioral balance assessment using Romberg test, Fukuda stepping test, Tandem gait test, past pointing tests on 10 healthy individuals.
3. Perform tests for cerebellar function like alternate pronation-supination of palm, tracking of shin bone by the heel, use of appropriate strategies to pick up objects on 5 healthy individuals.
4. Perform head impulse test, head shake test and subjective visual vertical (bucket test) on 5 healthy individuals.
5. Obtain cVEMP and oVEMP from 5 healthy individuals.
6. Perform vHIT on 5 healthy individuals.
7. Carry out tests for peripheral and central vestibular dysfunction (ocular motility testing) using ENG/VNG on 5 healthy individuals.
8. Observe the procedure for bithermal caloric test.
9. Watch the videos of various repositioning maneuvers and vestibular rehabilitation exercises and administer them on 5 healthy individuals.
10. Write reports about all the above.

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Unit 2: Assessment of vestibular system

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Unit 3: Disorder of the vestibular system

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Unit 4: Management of vestibular dysfunction

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Paper Code: AUD 3.5 b - Auditory Physiology

Syllabus as given in I semester (1.4 a)

Paper Code: AUD 3.5 c - Technology for Speech-Language & Hearing

Syllabus as given in I semester (1.4 b)

Paper Code: AUD 3.6 - HC: Clinical Practicum III

Paper Code: AUD 3.7 - SC: Dissertation

SEMESTER IV

Paper Code: AUD 4.1 - HC: Assessment and Management of Central Auditory Processing Disorders

Objectives:

After completing this subject, the candidate should be able to

1. List the types of CAPD and explain their physiological bases.
2. List the signs and symptoms of CAPD and correlate them with different central auditory processes.
3. List different tests of CAPD and independently design appropriate test protocol for clients with different signs and symptoms.
4. List and explain the factors affecting the assessment.
5. Explain construction and standardization of test of CAPD.
6. Explain management strategies and techniques for improving different central auditory processes.

Unit 1: Introduction to central auditory processing disorder (CAPD) & screening 18 Hrs

1.1 Overview to CAPD

- Critical evaluation of definitions of CAPD
- Processes and cognition involved in CAPD:
 - Binaural integration
 - Binaural separation
 - Temporal processing
 - Auditory closure
 - Binaural interaction
 - Phoneme synthesis
 - Auditory memory and sequencing
 - Sound localization and lateralization

1.2 Neural maturation and auditory processing; Neural degeneration and auditory processing

1.3 Signs and symptoms in individuals with specific central auditory deficits

1.4 Classification of auditory processing disorder; CAPD as a co-morbid disorder

1.5 Screening for CAPD

- Need / utility of screening for CAPD
- Screening questionnaires / check lists for children and adults; Sensitivity and specificity
- Screening tests for children and adults; Sensitivity and specificity
 - Sub-tests of speech / language tests
 - Audiological tests

Unit 2: Diagnostic assessment of CAPD 18 Hrs

- 2.1 Physiological assessment in assessment of CAPD:
 - ABR, AMLR, ALLR, MMN, P300 and other potentials
 - Contralateral suppression of OAEs
- 2.2 Behavioural tests in assessment of CAPD/ cognition:
 - Temporal processing
 - Binaural interaction
 - Binaural integration
 - Auditory separation / closure
 - Tests for assessing auditory memory and sequencing
 - Assessment of CAPD in subjects with peripheral hearing loss
 - Selection of CAPD tests based on signs and symptoms / performance on screening tools
- 2.3 Factors affecting assessment of CAPD
 - Factors related to subject
 - Factors related to procedure
- 2.4 Behavioural and physiological tests:
 - Relation between behavioural and physiological tests in different processes
- 2.5 Performance on tests of CAPD/ order cognition in:
 - Children
 - Young adults
 - Older adults

Unit 3: Overview to management of CAPD 18 Hrs

- 3.1 Direct remediation techniques
 - Bottom-up approaches
 - Top-down approaches
 - Environmental modifications in school set-ups, work place; Compensatory strategies for children and adults
- 3.2 Devices for subjects with auditory processing disorder; Outcome measures of devices for CAPD
- 3.3 Phoneme synthesis training; Vigilance training; Auditory memory and sequencing training
- 3.4 Meta-cognitive and meta-linguistic approaches
- 3.5 Role of auditory plasticity in management of CAPD

Unit 4: Techniques and outcome of Process specific management of CAPD 18 Hrs

- 4.1 Auditory perceptual training for binaural integration and binaural separation
- 4.2 Auditory perceptual training for temporal processing (temporal ordering, temporal resolution, etc)
- 4.3 Auditory perceptual training for auditory closure
- 4.4 Auditory perceptual training for binaural interaction & sound localization and lateralization
- 4.5 Factors affecting management of CAPDs; Team approach for assessment and management of CAPD

Practicum:

- For the signs and symptoms of CAPD provided by the faculty, select the appropriate tests and list the possible results with justification.
- Administer any two screening tools on 10 children.
- Administer at least 2 CAPD diagnostic tests on 2 adults, compare with available norms.
- Based on the CAPD test results make recommendations for management.
- Write activities for different meta-cognitive strategies
- Write activities for different meta-linguistic strategies.

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Unit 3: Overview to management of CAPD

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Unit 4: Techniques and outcome of process specific management of CAPD

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Paper Code: AUD 4.2 - HC: Audiology in Practice

Objectives:

After studying this course, student should be able to

1. Know the role of an Audiologist in different set-ups.
2. Liaison with other professionals in setting-up an audiological clinic.
3. Audit the practices in existing set-ups.
4. Implement acts and legislations concerned with hearing disability.
5. Know the role of Audiologist in legal matters.

Unit 1: Audiology practice in different set-ups

18 Hrs

- 1.1 Scope, challenges and solutions of audiological practices in
 - Rural/tribal areas
 - Medical setup
 - Industrial setup
 - School setup
 - Private practice
- 1.2 Tele-practice in Audiology
 - Concept of tele-practice
 - Need for tele-practice
 - Method, infrastructure and human resource requirement
 - Advantages and limitations of tele-practice
- 1.3 Allied professionals to be involved and their scope in screening / diagnostic work in
 - Rural/tribal areas
 - Paediatric set-up
 - Neurological set-up
 - Otolaryngological set-up
 - Industrial set-up
 - School set-up
- 1.4 Marketing, business, fundraising in Audiological practice
 - Need
 - Strategies
 - Ways to overcome problems

Unit 2: Construction and development of audiology set-ups

18 Hrs

- 2.1 Designing acoustically treated rooms:
 - Transmission loss
 - Reverberation control
 - Illumination
 - Electrical connections-electrical shielding, grounding and connecting jacks
 - Professionals involved in designing/construction audiological test facility

- 2.2 Differences in the infrastructure (equipment, space, room design, financing) requirements for
 - Rural/tribal areas
 - Paediatric set-up
 - Neurological set-up
 - Otolaryngological set-up
 - Industrial set-up
 - School set-up
 - Private practice
 - Audiology practice in medical colleges and hospitals
- 2.3 Setting up of a speech and hearing college
- 2.3 Auditing Processes in different set-ups
 - Method to audit
 - Goals to be achieved
 - Measures to be taken to prevent malpractice by allied professionals

Unit 3: Welfare measures for individuals with hearing-impairment 18 Hrs

- 3.1 Scope of different Government departments/ non-Government organizations in prevention, identification, rehabilitation and follow-up of individuals with hearing impairment:
 - Health & Family Welfare
 - Women & Child Development
 - Social Justice & Empowerment
 - Education Department
 - Human Resource Department
 - Others Government Departments
 - Non-Government Organization
- 3.2 Facilities available for the individuals with hearing impairment in India
 - Comparison with other disabilities
- 3.3 Role of the audiologist as a policy maker
 - In committees dealing with disability issues (Eg. RCI, PWD Act)
 - In committees dealing with hearing devices (Eg. BIS, ADIP scheme)

Unit 4 : Law and audiology 18 Hrs

- 4.1. Ethics in practice (in India and in other countries)
- 4.2. Medico-legal aspects in Audiology
 - Forensic Audiology
 - Audiologist as an expert witness
 - Report writing
- 4.3 Auditing of implementation of Acts and Legislations:
 - PWD act, RCI act, FDA, UNCRPD, NPPCD, Sarvasiksha Abhiyan
 - Biwako Millenium Framework, Salamanca statement and framework
 - Insurance Against Malpractice, Consumer Protection Act, Evidence Act

Practicum:

1. To explain various legislations and National Acts such as - PWD Act, RCI Act, FDA, UNCRPD, NPPCD, Sarvasiksha Abhiyan.
2. To explain Biwako Millenium Framework, Salamanca statement and framework.
3. To explain various welfare measures for the individuals with hearing impairment in India regarding travel, education, vocation, others, comparison with other disabilities.
 - i. RCI, PWD Act
 - ii. BIS, ADIP scheme
4. To prepare a project proposal for developing an audiology clinic in one of the following set-ups
 - i. Rural/tribal areas
 - ii. Paediatric set-up
 - iii. Neurological set-up
 - iv. Otolaryngological set-up
 - v. Industrial set-up
 - vi. School set-up
 - vii. Make an indent for procurement of an audiological equipment.

Reference:

Unit 1: Audiology practice in different set-ups

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Unit 2: Construction and development of audiology set-ups

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Unit 3: Welfare measures for individuals with hearing-impairment

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Unit 4: Law and audiology

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3. Rizzo, S.R., & Trudeau, M.D. (1994). Clinical administration in audiology and speech language pathology. San Diego: Singular Publishing Group Inc.
4. Stephen, R.R., Jr., Trudeau, D.M. (Eds.) (1994). Clinical administration in audiology & speech language pathology. San Diego: Singular Publishing Group Inc.

Various Indian and international legislations.

Paper Code: AUD 4.3 - HC: Speech Perception in Clinical Population

Objectives:

After completing this course, the candidate should be able to

1. Explain about speech perception in individuals with different configurations, types, degrees of hearing impairment
2. Differentiate / compare perception of speech through different senses and listening devices
3. Critically examine different methods to evaluate speech intelligibility, and describe the factors effecting speech intelligibility
4. Apply information on speech intelligibility / speech perception in the field of speech and hearing

**Unit 1: Perception of vowels and consonants in individuals with hearing impairment
18 Hrs**

- 1.1 Perception of vowels, semivowels, and diphthongs in individuals with hearing impairment.
- 1.2 Perception of consonants in individuals with a hearing impairment.
- 1.3 Effect of type, degree and audiogram configuration in perception of vowels and consonants.

Unit 2: Perception of coarticulation and suprasegmental 18 Hrs

- 2.1 Perception of coarticulation in individuals with hearing impairment.
 - Perception of vowels from adjacent consonantal segmental cues.
 - Perception of consonants from adjacent vowel segmental cues.
 - Perception of vowels from adjacent vowel segmental cues.
 - Perception of consonants from adjacent consonant segmental cues
 - Influence of direction of coarticulation on perception.
- 2.2 Perception of suprasegmental cues in individuals with hearing impairment:
 - Perception of stress,
 - Perception of rhythm
 - Perception of intonation
- 2.3 Perception of speech through the visual modality
 - Perception of segmental and suprasegmental cues
- 2.4 Perception of speech through the tactile modality
 - Perception of segmental and suprasegmental cues
- 2.5 Audio-visual integration of speech in individuals with SN hearing loss

Unit 3: Speech perception through different devices

18 Hrs

3.1 Perception of speech through cochlea implants

- Overview of speech perception through single channel implants:
 - Vowels perception
 - Consonants perception
 - Speech identification scores
 - Suprasegmental cues

3.2 Perception through multi-channel cochlear implants

- Vowels perception
- Consonants perception
- Speech identification scores
- Suprasegmental cues

3.3 Effect of the following on speech perception

- Coding strategy
- Threshold, comfort levels and Dynamic range
- Frequency allocation of electrodes
- Number of channels and maximas
- Stimulation rate and pulse width
- Pre-processing strategies and other noise reduction procedures

3.4 Speech perception through implanted hearing aids, middle ear implants, auditory brain-stem implants and mid-brain implants

3.5 Perception of speech through digital hearing aids

- Influence of out-put limiting circuits on perception for different degrees of hearing loss and audiogram configuration
- Influence of number of channels on perception for different degrees of hearing loss and audiogram configuration

Unit 4: Speech intelligibility and listening in adverse listening conditions 18 Hrs

4.1 Speech intelligibility

- Subjective procedures
 - Perceptual tests to evaluate perceptual deviance
 - Perceptual procedures to evaluate production deviance
- Objective procedures
 - Articulation index and its modifications
 - Speech transmission index
- Comparison of subjective and objective procedures
- Factors influencing speech intelligibility
 - Stimulus based factors
 - Subject based factors
 - Transmission based factors

4.2 Speech perception in adverse listening conditions

- Effect of noise on speech perception in normal and the hearing impaired
 - Effect of different types of noise
 - Effect of different signal-to-noise ratios
 - Effect on different age groups
 - Effect on different degrees of hearing-impairment
- Effect of reverberation on speech perception
 - Effect of different reverberation times
 - Effect on age different age groups
 - Effect on different degrees of hearing-impairment
- Combined effect of noise and reverberation on speech perception
- Effect of nonnative accent on speech perception

4.3 Application of speech perception in:

- Evaluation of the hearing impaired
- Rehabilitation of the hearing impaired
- Research regarding the hearing- impaired.

Practicum:

1. Evaluate the importance of burst and transition on perception of stops in 5 individuals with simulated conductive hearing loss
2. Evaluate the importance of burst and transition on perception of stops in 5 individuals with simulated SN hearing loss with different cutoff frequencies
3. Measure the effect of number of channels, frequency band on speech perception in cochlear implant simulated speech on normal hearing adults
4. Measure speech perception for CV syllables and words in various SNR and reverberation times
5. Calculate audibility index for 5 different degree and 5 different configuration of hearing loss with and without correction factors

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Paper Code: AUD 4.4 - HC: Clinical Practicum IV

Paper Code: AUD 4.5 - SC: Dissertation

Paper Code: AUD 2.5 - OE: Signal Processing Strategies and Their Implementation in Hearing Aids

Objectives:

- a) To give an overview of the latest technology of hearing aids
- b) To provide fundamental concepts of digital signal processing.
- c) To learn the various signal processing strategies used in hearing aids
- d) To understand and observe the effects of signal processing strategies.
- e) To learn the procedures for electroacoustic evaluation of hearing aids.
- f) To learn how to setup and use the equipment for measurement of spectral and temporal characteristics analysis of hearing aid output.

Unit 1: Introduction to hearing aid components

12 Hrs

1.1 Hearing aid components

- Microphones: Basic structure & principle of operation of electret microphones, single port and dual port microphones and microphones in body worn, BTE & ITC hearing aids, microphone sensitivity
- Telecoil: Basic structure, principle of operation & frequency response of active and passive telecoil
- Receivers: Basic structure & principle of operation of moving coil and balanced armature type receivers.

1.2 Hearing aid controls and their variations

- Volume control
- OTM switch
- Battery door switch
- Output control
- Other trimmer controls

1.3 Hearing aid accessories

- Battery: Various types and their characteristics
- Chords: Various types
- Ear hooks: Types and frequency shaping
- Connecting tube: Types and frequency shaping

Unit 2: Introduction to digital signal processing

12 Hrs

2.1 Digital signal processing

- Basic structure of a Digital signal processing system
- Process of Analog to Digital conversion
- Process of Digital to Analog conversion
- Basic concepts of Digital Signal Processing - Decomposition, Processing and Synthesis

2.2 Implementation of *Signal processing functions* using DSP

- Amplifiers
 - Filters
 - Types of digital filters
 - Basic architecture of a fully digital Hearing Aid
- 2.3 Advantages of DSP in hearing aid signal processing
- Major characteristics of DSP
 - Advantages of DSP analog processing
 - Features in hearing aids due to DSP

Unit 3: Signal processing in hearing aids 15 Hrs

- 3.1 Nonlinear amplification
- Basic technology - Input compression, output compression
 - Dynamic characteristics
 - BILL & TILL
 - Channel Separation
- 3.2 WDRC & Output limiting
- Signal processing techniques for Implementation of WDRC
 - Negative effects of DSP based WDRC
 - Signal processing techniques for output Limiting
- 3.3 Noise reduction & feedback cancellation
- Signal processing techniques for noise reduction
 - Noise reduction through microphone technology

Unit 4: Objective studies on hearing aids 15 Hrs

- 4.1 Electroacoustic parameters
- Procedure of electroacoustic evaluation defined by International Standards
 - National standards and the difference in procedures
 - ISTS Stimuli
 - Equipment setup for electroacoustic evaluation
- 4.2 Objective studies of temporal behaviour
- Equipment setup
 - Techniques for measurement
 - Techniques for analysis
- 4.3 Objective studies of spectral behaviour
- Equipment setup
 - Techniques for measurement
 - Techniques for analysis

Practicum:

- a) Basic structure of transducers.
- b) Measuring electroacoustic parameters
- c) Objective studies of temporal behavior
- d) Objective studies of spectral behavior

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Paper Code: AUD 2.5 - OE: Prevention and Screening of Hearing Impairment

Objectives:

After studying this course, the students are expected to appreciate the:

1. Importance of prevention and early identification of hearing impairment
2. Ways to prevent hearing impairment
3. Ways to screen hearing impairment at early stage
4. Need for early rehabilitation
5. Need for counselling and making appropriate referrals

Unit 1: Hearing and hearing loss 18 Hrs

- 1.1 Physical attributes of sound
- 1.2 Overview of the ear, its function
- 1.3 Role of hearing, impact of hearing loss, classification of hearing impairment
- 1.4 Causes of hearing loss
- 1.5 Signs and symptoms of hearing impairment
- 1.6 Development of human auditory behavior

Unit 2: Prevention and early identification of hearing impairment 18 Hrs

- 2.1 Need for prevention and early identification of hearing impairment
- 2.2 Different levels of prevention – primary, secondary and tertiary
- 2.3 Critical age concept and sensitivity period for language acquisition
- 2.4 Requirements of a good screening tool
- 2.5 Subjective test procedures and interpretation (Case history, check lists, behavioural observation)

Unit 3: Screening for hearing impairment 18 Hrs

- 3.1 Objective screening tests procedure (OAE and ABR)
- 3.2 Individual and group screening / Role of mass media in screening
- 3.3 Interpretation of screening results and appropriate referrals
- 3.4 Sensitivity and specificity of different screening tools
- 3.5 Strategies to ensure follow-up of referred clients

Unit 4: Early intervention of hearing impairment 18 Hrs

- 4.1 Need for early intervention
- 4.2 Counselling and referral for therapeutic management
- 4.3 Team members and their role
- 4.4 Overview to management techniques (hearing devices, modes of communication and modes of education)

Practicum:

1. Prepare a chart on development of auditory behaviour.
2. Administration of hrr on caregivers or significant others of at least 2 children.
3. Administer hearing screening tests and use of noise makers in at least 3 children.
4. Observation of hearing evaluation and hearing aid trial of children and adults (1 each).
5. Observation of auditory training (2 sessions).
6. Maintenance of record of the above.

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