



UNIVERSITY OF MYSORE

M.Sc. (Audiology) CBCS and CAGP Regulations – 2012

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 2012- 2013.

2.0 Duration of the program

2.1 Duration of the program: 4 Semesters / 2 years

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

3.0 Definitions

3.1 **Course (paper)** 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 is 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 candidate 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 candidate 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 candidate's proficiency/ skill is



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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 candidate 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 another special course of 7 credits involving a problem solving component.

4.0 Eligibility for admission.

4.1 Candidates with a BASLP / 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 considered as equivalent.

4.1.2 The program should be **approved by RCI** and

4.1.3 An average of not less than 50% of marks in the qualifying examination.

[**Note:** ‘Average’ refers to the average of the aggregate marks of all the years/semesters of BASLP/ B.Sc. (Speech & Hearing) 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 candidates who secure more than 40% 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 candidates in the subjects of B.Sc. (Speech & Hearing)/BASLP.

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.

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 Candidates shall attend camps/extension programs/educational tour conducted by the institution.

5.4 A Master’s Degree program is of 4 semesters-two year’s duration. A candidate 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 candidate opts for blank



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semesters, he /she has to study the prevailing courses offered by the department when he / she continues his / her studies.

- 5.5 A candidate has to earn a minimum of 76 credits for successful completion of the master's degree. The 76 credits shall be earned by the candidate by studying Hardcore, Softcore /electives / dissertation / Clinical Practicum, as specified in the program. The degree shall be awarded at the end of the two years.
- 5.6 Only such candidates who register for a minimum of 18 credits per semester 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 candidate 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 Shortage of attendance up to 5% in theory classes and up to 10% in clinical practicum can be recommended for condonation by the Head of the Institution, to the Vice Chancellor, in accordance with the prevailing rules of the University.
- 6.3 A candidate who is having shortage of attendance in clinical practicum is permitted to make up this shortage by attending clinical work during vacation/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.
- 6.4 A candidate, who fails to satisfy the requirement of attendance in a course, shall rejoin the same course in the immediate next academic year.
Note: This facility shall be available only **once** in the entire programme.
- 6.5 If a candidate represents his/her Institution in Sports/NSS/Cultural or any official activities, he/she is permitted to avail to a maximum of 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 candidate 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 candidate 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 half of the semester, the first 50% of the syllabus (the first two units of the total 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 candidates after obtaining acknowledgement in the register maintained by the concern 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/Speech-Language Pathology which would be conducted by internal examiners.

8.3.2 Clinical practicum is part of all the semesters. The internal assessment will be conducted continuously, through the semesters.

8.3.3 Break-up of marks of clinical practicum shall be as follows:

8.3.3 Break-up of marks of clinical practicum shall be as follows:

Odd semesters:

Components	Basis of assessment
C 1 + C2 : 50 marks <i>(internal assessment)</i>	<ul style="list-style-type: none"> • Clinical skill/repertoire • Planning, assessment & management of therapy • Preparation and maintenance of clinical documents (test protocols, diary, lesson plans and progress report) • Rapport with stakeholders • Efficient use of time/skills in execution • Professional attitude/motivation/aptitude for clinical work
C 3 : 50 marks <i>(clinical viva)</i>	Clinical viva-voce conducted by three internal examiners consisting of clinical staff/faculty , who shall examine the candidate's clinical skills(prior to the commencement of the theory examination).

Even semesters:

Components	Basis of assessment
C 1 + C2 : 50 marks <i>(internal assessment)</i>	<ul style="list-style-type: none"> • Clinical skill/ repertoire • Planning, assessment & management of therapy • Preparation and maintenance of clinical documents(test protocols, diary, lesson plans and progress report) • Rapport with stakeholders • Efficient use of time/ skills in execution • Professional attitude/ motivation/aptitude for clinical work
C 3 : 50 marks <i>(clinical viva)</i>	Clinical viva- voce conducted jointly by internal and external examiners , who shall examine the candidate's clinical skills (prior to the commencement of the theory examination).

8.3.4 In case a candidate secures less than 30% in C1and C2 put together in a course, the candidate is said to have DROPPED that course, and such a candidate is not allowed to appear for C3 in that course.

In case a candidate's class attendance in a course is less than the stipulated percentage, the candidate is said to have DROPPED that course, and such a candidate is not allowed to appear for C3 in that course.



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In case a candidate secures less than 30% in C3, he/she may choose DROP/MAKEUP option.

In case a candidate secures more than or equal to 30% in C3, but his/her grade (G) = 4, as per section 6.9 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=4 shall not be availed for a maximum of 8 credits for the entire programme of Master's Degree of two years.

In case a candidate secures more than 30 % in C3 but G=4, then he/she may choose DROP/MAKE-UP option. The candidate has to exercise his/her option immediately within 10 days from the date of notification of results. A MAKE-UP examination will be conducted within 25 days from the date of notification of results. If the candidate still remains unsuccessful after MAKE-UP examination he/she is said to have DROPPED that course.

A candidate 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 candidate may choose the same or an alternate core/elective in case the dropped course is soft core / elective course. A candidate who is said to have DROPPED project work 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..

8.4 Dissertation work

8.4.1 There shall be 100 marks for dissertation work. 25% of the marks will be awarded in the III semester and 75% in the IV semester.

8.4.2 Right from the initial stage of defining the problem, the candidate has to submit progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the guide. Components of evaluation are as follows:

III Semester:

Components	Basis	Remarks
C 1 : 25%	Preparation of research proposal	To be awarded by the Guide
C 2 : 25%	Research proposal	To be evaluated by a panel of two members consisting of the guide and an internal examiner
C 3 : 50%	Periodic progress and progress report following Research proposal.	To be awarded by the Guide



IV Semester:

Components	Basis	Remarks
C 1 : 25%	Periodic progress and progress report	To be awarded by the Guide
C 2 : 25%	Results of Work and Draft Report	To be awarded by the Guide
C 3 : 50% Report evaluation: 35% and Viva- voce examination: 15%	Final viva-voce and evaluation	To be evaluated by a panel of two members consisting of the guide and an external examiner

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

8.4.4 A candidate who is said to have DROPPED dissertation work has to re-register for the same subsequently within the stipulated period.

8.5 Setting questions papers and evaluation of answer scripts.

8.5.1 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 only external valuation for all theory papers. The marks awarded by the external examiners shall be taken as the final marks for that particular course.

IV. Challenge valuation: A student who desires to apply for challenge valuation shall obtain a photocopy copy 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 in the challenge valuation shall be the final.

8.5.2 In case of a course with only practical component a practical examination will be conducted with both internal and external examiners. A candidate will be assessed on the basis of a) knowledge of relevant processes b) Skills and operations involved c) Results / products including calculation and reporting. If external examiner does not turn up then both the examiners will be internal examiners. The duration for semester-end practical examination shall be decided by the departmental council.

8.5.3 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 candidate in the theory examinations. If **X** is the marks scored by the candidate out of 50 in C₃ in theory examination, if **Y** is the marks scored by the candidate out of 50 in C₃ in Practical examination, and if **Z** is the marks scored by the candidate 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

8.5.4 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

8.5.5 A candidate'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).

8.5.6 **Finally, awarding the grades should be completed latest by 24th week of the semester.**

8.6 In case a candidate secures less than 30% in C1 and C2 put together in a course, the candidate is said to have DROPPED that course, and such a candidate is not allowed to appear for C3 in that course.

In case a candidate's class attendance in a course is less the stipulated percentage, the candidate is said to have DROPPED that course, and such a candidate is not allowed to appear for C3 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 C3, and subsequently a notification pertaining to the above will be brought out by the Chairman of the Department before the commencement of C3 examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

8.7 In case a candidate secures less than 30% in C3, he/she may choose DROP/MAKEUP option. In case a candidate secures more than or equal to 30% in C3, but his/her grade (G) = 4, as per section 6.9 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=4 shall not be availed for a maximum of 8 credits for the entire programme of Master's Degree of two years.

In case a candidate secures more than 30 % in C3 but G=4, then he/she may choose DROP/MAKE-UP option. The candidate has to exercise his/her option immediately within 10 days from the date of notification of results. A MAKE-UP examination will



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be conducted within 25 days from the date of notification of results. If the candidate still remains unsuccessful after MAKE-UP examination he/she is said to have DROPPED that course.

- 8.8 A candidate 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 candidate may choose the same or an alternate core/elective in case the dropped course is soft core / elective course. A candidate who is said to have DROPPED project work 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.
- 8.9 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.
- 8.10 Upon successful completion of Masters degree, a final grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Registrar (Evaluation).
- 8.11 The grade and the grade point earned by the candidate in the course will be as given below.

P	G	GP = V x G
90-100	10	V X 10
80-89	9	V X 9
70-79	8	V X 8
60-69	7	V X 7
50-59	6	V X 6
40-49	5	V X 5
30-39	4	V X 4
0-<30	0	V X 0

Here, P is the percentage of marks ($P=[(C_1+C_2)+M]$) secured by a candidate 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.

- 8.12 A candidate 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 candidate 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 candidate 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.
- 8.13 Overall cumulative grade point average (CGPA) of a candidate after successful completion the required number of credits (76) is given by

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



9. Classification of results:

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate 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 = $10 * \text{CGPA}$ or is said to be 50% in case of $\text{CGPA} < 5$

10.0 Provisions for Repeaters

10.1 A candidate is allowed to carry all the previous unleared papers **except clinical practicum** to the subsequent semester/semesters subject to Regulation 8.3.3.

11 Provision for appeal

11.1 If a candidate, 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 candidate 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 candidate 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 candidate 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 candidates admitted for the academic year 2012-13 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

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Sl. No.	Paper 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 paper
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 Physiology
	1.3	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Basics in Auditory Perception
	1.4	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Physiological Assessment of the Auditory System
	1.5	1:1:0	2		L=1x1=1 T=2x1=2	3		SC	<i>Technology for Speech-Language & Hearing</i> OR <i>Clinical Counseling</i> OR <i>Speech Production</i> OR <i>Diseases of the ear and auditory pathway</i>
	1.6*	0:0:4	4		C=4x4=16^	16		HCC	Clinical Practicum I
II	2.1	2:1:0	3	19	L=1x2=2 T=2x1=2	4	38	HC	Neurophysiology of Hearing
	2.2	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Psychophysics of Audition
	2.3	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Electrophysiological Assessment of the Auditory System
	2.4	1:1:0	2		L=1x1=1 T=2x1=2	3		SC	<i>Vestibular system: assessment & management</i> OR <i>Clinical Neuropsychology</i> OR <i>Clinical Behavior Analysis</i>
	2.5	(3 credits)	3			3		OE	
	2.6*	0:0:4	4		C=4x4=16^	16		HCC	Clinical Practicum I
	2.7*	0:0:1	1		C=4x1=4^	4		SCC	Clinical Practicum II



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Sl. No.	Paper 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 paper
III	3.1	2:1:0	3	20	L=1x2=2 T=2x1=2	4	40	HC	Psychophysics of Audition in hearing impaired
	3.2	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Implantable Devices for individuals with hearing impairment
	3.3	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Speech Perception
	3.4	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Seminars in assessment of hearing impairment
	3.5	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Seminars in Rehabilitative Audiology
	3.6*	0:0:4	4		C=4x4=16 [^]	16		HCC	Clinical Practicum I
	3.7	D	1		D=4x1=4 [^]	3+1 [^]		HC	Dissertation
IV	4.1	2:1:0	3	19	L=1x2=2 T=2x1=2	4	34	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		HCC	Clinical Practicum I
	4.5	D	6		D=1x6=6	5+1 [^]		HC	Dissertation
				76					

*Clinical practicum (internal) shall begin from I/III semester.

[^] One hour each would be used for CC/JC

HCC: Hard core clinical; SCC: Soft core clinical: Examination of ear with different pathology, repair of hearing aids, speech synthesis, counseling & guidance, Neuropsychological evaluation & LD evaluation and therapy.

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

1. To enable the students to understand and deduce the use of research methods from the review of literature
2. To prepare the students on the application of the research methods and techniques in communication disorders
3. To enable them to choose appropriate research designs to carry out research in the field
4. To critically evaluate the research design in literature
5. To understand the applications of Statistics in the field of Speech-Language Pathology and Audiology
6. To know basic concepts of Statistics
7. To learn various types of tests of significance, applicable to the field of Speech and Hearing and practice manual application of these tests

Unit 1

- Review of basic research methods, types, strategies and designs. (Ex-post facto research, Normative research, Standard group comparison, Experimental research, Clinical and applied research, Sample surveys, Evaluation research and Epidemiological research) with special focus on review of literature on research methodology in the field of Speech language pathology and Audiology since 1920s
- Methods of Observation and measurement in speech language pathology and Audiology.

Unit 2

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

Unit 3

- Review of basic statistics
- Methods of correlation & regression (with numerical examples)
- Review of comparison of two means (independent t-test and paired t-test with numerical examples)

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- Analysis of variance (ANOVA): Basic model, Types, assumptions, one-way and two-way ANOVA (with numerical examples), Post-hoc tests, concept of repeated measure ANOVA
- Multivariate data analysis (Introduction only): Need for multivariate analysis, Introduction to various methods viz., Principal component analysis, Cluster analysis, Discriminant analysis, MANOVA

Unit 4

- Consequences of failure of assumptions underlying parametric tests, need for transformations and non-parametric tests.
- Non-parametric tests (with numerical examples) – Mann –Whitney U test, Wilcoxon's signed-rank test, Median test, Sign test, Kruskal – Wallis test, Friedman test
- Analysis of qualitative data: Contingency tables, Chi-square test for independence of attributes, measures of association (Contingency coefficient, Cramer's V), Kappa coefficient (with numerical examples)
- Application of statistics to speech-language pathology & audiology with specific examples.

Reference:

Unit 1:

1. Grosf. M.S., Sardy. H. (1985). A research primer for the social & behavioral sciences. New York. Academic press.
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3. Gibbon (1993). Nonparametric statistics – An introduction. London: Sage publications
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5. Michael, S. L. (Editor) (1993): Basic Statistics – International hand books of quantitative applications in the social sciences , Vol 1, Sage Publications, London
6. Philip, H. D. (1965). An introduction to psychological statistics, Harper and Row, New York
7. Sancheti , Kapoor (1981) . Statistics : Theory, Methods and Application, Sultanchand and sons, New Delhi
8. Seigal, S. (1956). Non-parametric Statistics for the Behavioral Sciences. Tokyo: McGraw Hill.

Paper Code: AUD 1.2 - HC: Auditory Physiology

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

1. The different parts of the peripheral auditory system and vestibular system
2. The functioning of normal peripheral auditory system and vestibular system
3. The methods used to study auditory physiology
4. Give insights into the physiological basis of physiological tests used for hearing assessment
5. Applying the knowledge of auditory physiology to take appropriate clinical decisions

Unit 1: Conductive mechanism of auditory system

- External Ear: Anatomy and physiology of lower animals & humans
 - Role of Pinna & External auditory meatus in hearing.
 - Resonance properties of external ear in human.
- Temporal bone anatomy.
- Middle ear: Anatomy & Physiology of lower animals and humans
 - Middle ear transformer action
 - Concept of acoustic impedance
 - Acoustic and non acoustic reflex pathways
 - Anatomy & physiology of the Eustachian tube

Unit 2: Anatomy of the sensory auditory system

- Cochlea: Anatomy in lower animals and human
- Macro & microanatomy
- Blood supply of inner ear
- Innervations of inner ear
- Proteins in the cochlea
- Cochlear regeneration
- Auditory system in lower animals

Unit 3: Physiology of the sensory auditory system

- Modes of bone conduction
- Cochlear fluids - Origin, composition, absorption, and dynamics
- Cochlear mechanics - basilar membrane mechanics -historical and current status.
- Cochlear transduction
- Cochlear electrophysiology
- Cochlear potentials their generation and properties.
- Cochlear non-linearity - two tone suppression, otoacoustic emission & other recent advances.
- Nutrients related to sensory cell physiology
- Physiology of auditory system in lower animals

Unit 4: Theories of hearing & vestibular system

- Historical aspects.
- Place theory - resonance & nonresonance.
- Frequency theory.
- Traveling wave theory.
- Other recent advances like motor theory etc.

Vestibular system:

- Anatomy of vestibular structure & vestibular nerve
- physiology of Vestibular structure & vestibular nerve
- Vestibular ocular reflex pathway & physiology
- Vestibular spinal reflex pathway & physiology

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Unit 1

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16. Zemlin, W. R. (1998). Speech & Hearing science: Anatomy & Physiology. Boston: Allyn & Bacon.

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Unit 4

1. Bekesy, G. V. (1960). *Experiments in hearing*. New York: Mc Graw Hill.
2. Bradford, L. J. (1975). *Physiological measures of the audio-vestibular system*. New York: academic press.
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Paper Code: AUD 1.3 - HC: Basics in Auditory Perception

Objectives

1. To familiarize the students with the effect of cochlear hearing loss on various psycho-acoustical tasks.
2. To familiarize the students with various procedures employed for these studies.

Unit 1 Introduction

- a. Introduction to signal Generation and Modifications of Acoustic Signals
- b. Theory of Signal Detection: basic concepts and application
- c. Psychophysical Methods: Classical and adoptive

Unit 2

a. Absolute and relative measures

- a. Concepts
- b. Methods of measuring absolute and relative (Difference Limen)

b. Loudness

- i. Minimum audible pressure, Minimum audible field, equal loudness contours
- ii. Loudness scaling: phons & Sones
- iii. loudness growth and psychophysical power law
- iv. Loudness of complex signals
- v. Difference limen for Intensity

c. Pitch

- i. Pitch Scales
- ii. Factors effecting pitch perception
- iii. Pitch of complex signals
- iv. Theories of pitch Perception
- v. Ohm's acoustic law
- vi. Consonance, dissonance and Musical intervals
- vii. Combination tones
- viii. Difference limen for frequency

Unit 3

a. Basic concepts of temporal processing

- I. Temporal resolution
- II. Temporal integration

b. Detection of Gaps

- I. Broad band noise
- II. Narrow band noise
- III. Sinusoids
- IV. Discrimination of Gaps

c. Temporal modulation transfer function

- I. Broad band noise
- II. Narrow band noise
- III. Sinusoids
- IV. Discrimination of Modulation Frequency

d. Auditory Pattern perception

- I. Timber Perception and Object Identification
- II. Time invariant-Pattern and Timber
- III. Time varying Patterns

Unit 4 - Auditory object Perception

- a. Basic concepts in auditory object
- b. t separation
- b. Spectral separation
- c. Spectral profile
- d. Harmonicity/ Temporal regularity
- e. Spatial separation
- f. Temporal Separation
- g. Temporal Onset and Offset
- h. Temporal Modulation

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Common to all units

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3. Brain, C.J. Moore (1986). Frequency Selectivity in Hearing, Academic Press Inc.
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12. Bregman, A.S. (1994). *Auditory Scene Analysis: The Perceptual Organization of Sound*, MIT press.
13. N. Grimault and E. Gaudrain. The consequences of cochlear damages on auditory scene analysis. *Current topics in Acoustical Research* (Web Ref: http://olfac.univlyon1.fr/unite/equipe-02/grimault-f_fichiers/Grimault-Gaudrain-2.pdf).
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19. Tobias, J.V. (1970). *Foundations of modern auditory theory*. Vol. I New York: Academic Press.
20. Tobias, J.V. (1983). *Foundations of modern auditory theory*. Vol. II New York: Academic Press.
21. Willam, A. Yost (1994). *Fundamentals of hearing* (all editions). CA: Academic Press Inc.

Paper Code: AUD 1.4 - HC: Physiological Assessment Of The Auditory System

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

1. Describe the bases of electrophysiological tests
2. Interpret electrophysiological test findings
3. List the generator/s for different auditory evoked potentials
4. Explain the importance of different potentials required for perception of speech & language
5. To select appropriate test parameters for assessing auditory nerve, auditory brainstem and auditory cortical functioning

Unit 1 – Tympanometry

- Principle and instrumentation of immittance evaluation
- Tympanometry: Low frequency Vs. Multifrequency tympanometry,
- Single vs. Multicomponent tympanometry,
- Variables effecting tympanometry
- Tympanometry in infants
- Tests used to assess Eustachian tube function
- Implication of tympanometric evaluation in differential diagnosis and management

Unit 2 - Reflexometry

- Acoustic and non-acoustic reflexes,
- Reflex adaptation, latency of acoustic reflex, reflex averaging, reflex sensitization
- Temporal summation of acoustic reflex, binaural summation of acoustic reflex
- Variables effecting their measurement of acoustic reflexes
- Importance of high frequency reflexometry in paediatric assessment
- Implication of acoustic & non acoustic reflexes in differential diagnosis and management
- Reflectometry
- Research needs in immittance evaluation.

Unit 3: Otoacoustic emissions

- Origin of OAEs,
- Classifications of OAEs
- Principles in recording of OAEs
- Interpretation of OAEs: Amplitude, latency, phase, and reproducibility
- Instrumentation of SOAE
- Recording of SOAE
- Synchronized SOAE
- Factors affecting SOAE
- SOAE & Tinnitus

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- Clinical applications of SOAE
- Suppression of SOAE

Unit 4: Evoked otoacoustic emission

- Instrumentation of TEOAE/DPOAE/SFOAE
- Recording of TEOAE/DPOAE/SFOAE
- Factors affecting TEOAE/DPOAE/SFOAE
- Evoked OAEs & Tinnitus
- Clinical applications of TEOAE/DPOAE/SFOAE
- Contralateral & ipsilateral suppression of TEOAE/DPOAE/SFOAE
- Implication in differential diagnosis and management,
- Research needs in OAE

Reference:

Unit 1& 2

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- Jerger, J (1975). Hand book of clinical impedance audiometry, American Publisher Electromedics Corp.
- Silman, S. & Silverman, C.A.(1991). Auditory Diagnosis: Principles & Applications, San Diego, Academic Press.
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- Berlin, C.I. (Ed.) (1996). *Hair cells and hearing aids*. London: Singular publishing group.
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- Roeser, R. J., Valente, M., and Dunn, H. H. (2007). Audiology: Diagnosis. Thieme Publishers, New York.
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Unit 4

Shera & Guinan (1999) Evoked otoacoustic emissions arise by two fundamentally different mechanism: A taxonomy for mammalian cochlea *JASA*, 105 (2)

Sahley, T.L., Nodeer, R.H. and Musiek, F.E. (1997). *Efferent auditory system: Structure and function*. San Diego: Singular Publishing Group, Inc.

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Mills, D. M., & Rubel, E. W., (1994). Variation of distortion product otoacoustic emissions with furosemide injection, *Hearing Research*, 77, 183-199.

Common

Katz, J. (Ed.). (1994). *Handbook of Clinical Audiology*. Baltimore: Williams and Wilkins.

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Van De Water, T.R., Popper, A.N. and Fay. R.R. (Ed) (1996). *Clinical aspects of hearing*. New York: Springer

Paper Code: AUD 1.5 - SC: Technology for Speech-Language & Hearing

Objectives:-

- a. To give an overview of the latest technology involved in speech Acoustics, Signal processing, Instrumentation etc.
- b. To provide fundamental concepts of the technology used in the instruments for diagnostics and therapeutics in Speech Language Sciences and Pathology
- c. To learn the various signal processing strategies used in hearing aid amplification, noise reduction, channel based gain and output control.
- d. To understand and observe the principle of working and functioning of equipments used for measurement of sounds and calibration of diagnostic equipments.
- e. To learn practically the procedure for calibration of audiometers, middle ear analyzer, Otoacoustic emission analyzer, BERA etc.
- f. To lay the foundation of ICT (Information and Communication Technology) concepts and illustrate the applications of ICT in Speech & Language Pathology
- g. To demonstrate practically the concepts in basic principle of operation of transducers, amplifiers, display units and other signal processing and signal acquisition elements of bio medical instrumentation in speech and hearing.

Course Content:

Unit 1: Introduction to Transducers and Signal Processing components

Basic principle of operation of Microphones, Headphones, Insert Receivers, Loudspeakers and Bone Vibrators
Structure and working of Preamplifiers, Main amplifiers and Power amplifiers
Introduction to Batteries, AC and DC Power supplies
Introduction to Computers, Peripherals, computer networks, Operating systems and Application Softwares.

Unit 2: Introduction to Digital signal processing and Communication technology

Block diagram of a digital signal processing system
Principle and Functioning of Analog to Digital converter and Digital to Analog converter
Fundamental concepts of Digital Signal Processing - Decomposition, Processing and Synthesis
Implementation of Filters using DSP
Implementation of Amplifiers using DSP
Basic technique of amplitude and frequency modulation, structure of amplitude modulator, frequency modulator and pulse modulation systems.
Satellite communication and implementation of teleradiology & telerehabilitation system.

Unit 3: Signal processing in hearing aids, Speech processing and analysis

- a. Block diagram of analog and digital hearing aids and their comparison.
- b. Basic architecture of amplifiers in digital hearing aids]
- c. Signal processing techniques in channel separation, non-linear amplification, output limiting, noise control, feedback cancellation etc.
- d. Block diagram, structure, implementation, merits and demerits of group hearing aids and assistive listening devices.
- e. Basic architecture of speech processor in cochlear implants, its principles of working and speech processing strategies.
- f. Fundamentals of Matlab based signal processing and its application in audiology.
- g. Representation of a speech waveform in time and frequency domain
- h. Short time analysis techniques

Techniques for estimating long term average spectrum

- i. Applications of these techniques in
 - Speaker identification
 - Speaker verification
 - Speech recognition
 - Speech synthesis

Unit 4: Instrumentation in Audiology & Speech Language Pathology

Block diagram and functional description of :

- a) Speech Spectrograph and CSL
- b) Voice analysis systems
- c) Electro glotograph
- d) Articulograph
- e) Nasometer
- f) Fibre optic endoscope
- g) Therapeutic Instruments
- h) AAC devices

Basic structure and functioning of equipments and components used for measurement of sound and calibration

Block diagram, functional description and calibration procedure for :

- a) Audiometer
- b) Middle ear Analyzer
- c) Otoacoustic Emission Analyzer
- d) Instrumentation for Auditory Evoked Potential

Importance of grounding, procedure for making a perfect electric ground, checking the perfection of an electric ground.

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Procedure for noise auditing.

Room acoustics, factors to be considered while constructing an audiometric test room, sound proofing techniques.

Procedure for measurement of reverberation time

Fundamentals of imaging techniques such as X-Ray, CT scan, MRI, FMRI etc.

Reference:

1. The Acoustic Analysis of Speech
Singular Publishing Group. Kent, Ray D. K., Read, Chales.
2. Digital Processing of Speech Signlas. Prentice-Hall Inc. Lawerence R. Rabiner, Schafer, Ronald W.
3. Introduction to Digital Signla Processing. Prentice-Hall of India Pvt., Ltd. Johnson, R.
4. Applications of Digital Signal Processing to Audio and Acoustics. Kulwer Academic Publishers. Brandenburg, Kerlheinze.
5. Digital Signla Processing. Prentice Hall of India Pvt. Ltd. Oppenheim Av Schafer, Ronald W.
6. Science of Sound. Addison Wesley 3rd Ed. Richard Moore, Ruossing, Thomas D. Wheeler Paul A.
7. Encyclopedia of Acoustics. John Wiley andSons. Crocker, Malcoem J.

Paper Code: AUD 1.5 - SC: Clinical Counseling

Objectives:

1. To prepare students in the specific area of clinical counseling as a discipline seeking to understand counselor-client relationships in the context of training and rehabilitation of individuals with disorders in human communication.
1. To train students into practical skills and competencies required for mastering basics of clinical counseling in their practice for identification and management of persons with communication disorders
2. To sensitize pupils on the ethical aspects of clinical counseling when dealing with individuals or their families with communication disorders.
3. To develop ability for integrating counseling based aspects in the field of research in communication disorders.

Unit 1

Guidance and Counseling: Meaning, Nature, Scope, Principles and Goals - Types and Techniques: Individual and Group

Special Focus on Clinical Counseling: Need and Applications

Counseling across Life Span: Child, Adolescent, Parenthood, Sibling, Grandparent/Elderly;

Counseling across Relationships: Teacher, Family and Peer Group

Unit 2

Portrait of Effective Counselors – Qualifications and Qualities – Micro and Macro Skills and Competencies – Do's and Don'ts

Expectations and Limitations in Professional Clinical Counseling – Tips for Improvement – Ethical Issues

Outline of Conditions requiring Clinical Counseling: Organic Brain Syndromes-Functional Disorders-Psychotic and Neurotic Disorders-

Disabilities & Impairments - Personality & Conduct Disorders-Special Populations: HIV/AIDS, School Drop Outs, Chronic or Terminally III

Unit 3

Counseling Process: Stages in Clinical Counseling – Preparation and Pre-requisites – Middle Phase – Termination – Therapeutic

Relationships

Principles in Clinical Practice: Directive and Non-Directive

Approaches Tools for Clinical Counseling – Major Events (Transference, Counter Transference & Resistance)

Unit 4

Special Areas: Pre-marital, Marital, Vocational and Pre-vocational Clinical Counseling – Counseling the Differently Abled – Parent, Sibling and Grandparent Counseling – Crisis Counselling

Gender Counseling – Human Rights, Enablement and Empowerment through Counseling – Counseling the Elderly

Alternate/Holistic Forms of Counseling: Spiritual Counseling - Facilitation - Online Counseling - Contemplative Counseling – EMDR - Journal Therapy - Trauma Counseling - Emotional Freedom Technique - PSYCH-K Technique - Yoga & Meditation – Enneagram - Pastoral Counseling - Expressive Art Therapy - Gestalt Counseling - Massage Therapy – Scientific Basis, Cultural Constraints and Ethical Issues

References:

Unit 1:

1. Gelso, C.J. & Fretz, B.R. (1995). *Counseling Psychology*. New Delhi: A Prism Indian Edition.
2. Hansen, J.C., Stevic, R.R. & Warner, R.W. (1987). *Counseling*. Boston: Allyn & Bacon, Inc.,
3. Nelson-Jones, R. (1999). *Introduction to Counseling Skills*. London: Sage Publications.
4. Rao, N.S. (1981). *Counseling Psychology*. New Delhi: Tata McGraw Hill Pub. Co.
5. Palmer, S., Dainow, S. & Milner, P. (1996). *Counseling*. London, Sage Pubs.
6. Shertzer, B.S. & Stone, B. (1968). *Fundamentals of Counseling*. NY: Houghton Mifflin Co.

Unit 2:

1. Street, E. (1994). *Counseling for Family Problems*. London, Sage Publications.
2. Blackham, G.J. (1977). *Counseling – Theory, Process & Practice*. Belmont: Wadsworth.
3. Palmer, S. (1999). *Introduction to Counseling and Psychotherapy*. London: Sage Publications.
4. Corey, G. (2011). *Theory and practice of group counseling*. 8th Edition. California: Brooks/Cole Publishing Company.
5. Corey, G. (2001a). *The art of integrative counseling*. Pacific Grove, CA: Brooks/Cole.

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Unit 3:

1. Nelson-Jones, R. (1982). *The Theory and Practice of Counseling Psychology*. London: Holt, Rinehart and Wilson.
2. Corey, G. (2008). *Theory and practice of counseling and psychotherapy*. California: Brooks/Cole.
3. Corey, G., Corey, C., and Corey, M.S. (2008). *Groups: Process and Practice*. California: Brooks/Cole.
4. *Handbook of counseling psychology* by Woolfe and Dryden, Sage, New Delhi, 1996.
5. *Improving treatment compliance: counseling and systems strategies for substance abuse and dual disorders*, by Dennis C.Daley.

Unit 4:

1. Jacobs, Ed. E., Masson, R.L. & Harvill, R.L. (1998). *Group Counseling: Strategies & Skills*. Pacific grove, CA: Books / Cole Pub. Co.,
2. Madden, G.R. (1998). *Legal Issues in Social Work: Counseling and Mental Health*. Thousand Oaks: Sage Publications.
3. Thomas, R.M. (1990). *Counseling and Life-span development*. New Delhi: SAGE Pubs. India Pvt. Ltd.
4. Tudor, K. (1998). *Group Counseling*. London: Sage Publications.
5. *Group Counseling* by George M.Gazda, Allyn & Bacon, Boston, 1989.
6. *Intentional interviewing and counseling: facilitating client development in a multicultural society* by Allen E.Ivey, Wadsworth Co. 1998.
7. Hart, JT (1983). *Modern eclectic therapy a functional orientation to counseling and psychotherapy*. New York: Plenum.

Paper Code: AUD 1.5 - SC: *Speech Production*

Objectives:

After going through this course the student will be able to explain or understand

- Physiology and Theories of Speech Production,
- Acoustic characteristics and Acoustic analysis of Speech
- Spectrography and its clinical applications
- Instrumentation in speech production and speech acoustics

COURSE CONTENT

Unit 1:

Introduction to the study of speech acoustics

- a) The physiological arena of speech (respiration, laryngeal and articulatory subsystem)
- b) The acoustic arena of speech – Acoustic wave, Analog and digital signal, digitization, analog-to-digital converter, bandwidth, frequency resolution, window, block duration, pre-emphasis, block shift, characteristics of air borne acoustic signal

Acoustic analysis of speech

- a) Brief historic development – Oscillograph, Fourier analysis, spectrograph, digital signal processing (waveform analysis, FFT and LPC, pitch extraction, digital spectrogram, cepstrum, Auto correlation).
- b) Filtering – pre-emphasis filtering, pre-sampling filter, sampling, quantization

Acoustic theory of speech production: Thesis, source, types and its characteristics, filter / transfer function and its characteristics, output speech and its characteristics, cavity volume and resonance relationship, internal (Viscous friction and thermal conduction) losses in the vocal tract and their effect on spectra, external loss (lip radiation) and it's effect on spectra.

Acoustic characteristics of vowels and Diphthongs: Vowel formant pattern, vowel short-term spectrum, vowel duration, vowel fundamental frequency, formant bandwidth and amplitude, on glide and off glide of formants.

Acoustic characteristics of plosives: Vocal tract configuration, five distinct characteristics of plosives, closure duration, release burst, release burst spectrum, release burst amplitude, frication and aspiration, voice onset time, formant transitions, voicing characteristics.

Acoustic Characteristics of nasal consonants: Vocal tract configuration, formant frequencies, nasal murmur, formant damping, bandwidth, formant transition, antiformant

Acoustic characteristics of fricatives: Vocal tract configuration, classification of fricatives, acoustic characteristics of stridents and non-stridents, calculation of formant frequencies.

Acoustic characteristics of other consonants

Affricates: Vocal tract configuration, acoustic differences between affricates and plosives

Glides - Vocal tract configuration, formants, bandwidths, transitions, Liquids - Vocal tract configuration, formants, anti formants, bandwidth transitions, Acoustic studies in Indian languages

Acoustic effects of context and speaker: phonetic context, gender and age, women's speech, children's speech, role of acoustic methods in speech pathology.

Unit 2

Spectrography – Features to be identified on a spectrogram, Types of spectrograms and their uses, spectrograms of vowels and consonants, identifying place of articulation, manner of articulation, voicing and aspiration, identification of vowels, syllables, words, word boundaries and sentences. Theoretical and clinical application of spectrography.

Unit 3

Infant cry analysis – Why infant cry analysis? Factors affecting infant vocalization, communicative and vegetative vocalization, prenatal vocalization, perceiving neonatal cries, perceptual identification of cry types (mother's identification of their own infants, identification of gender, health status and prelinguistic vocalizations).

Acoustic attributes of cry signals – Length, f_0 , shift, voicing, melody types, continuity, glottal plosives, nasality, tension, subharmonic break / double harmonic break/ latency, second pause, biphonation / diplophonation, furcation, noise concentration, tonal pit.

Acoustics of normal and abnormal cries – Weight, oropharyngeal abnormalities, asphyxia neonatorum, central asphyxia with neurological symptoms, low birth weight, CNS disease, hydrocephalus, endocrine disturbances, metabolic disturbances, hypoglycemia, malnutrition, chromosomal and genetic deficits, cri-du-chat, Down's syndrome, Trisomy 13,18, subglottal, glottal and supraglottal pathologies.

Relation of cry acoustics to long-term outcome – Studies by Michelson et al (1977, 1984), cumulative cry score system, predictive value of infant cries, sudden infant death syndrome and cry test.

Models of cry production – source-filter theory, Gullefs model, Lester's model, Model of Porgies & Maita, Two-part biobehavioural model

Future directions in infant cry analysis

Acoustic analysis of laughter – Why acoustic analysis? Types of laughter, acoustic characteristics of laughter.

Unit 4

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.

Lower air way dynamics – Size and shape of alveolar sacs, constrictors in lower airway, laryngeal activity in speech, Bernoulli's principle, lung volumes in breathing, conversational speech and loud speech, effect of glottal activity on air pressure and air flow, glottal activity during stops consonants, glottal resistance in vowels and consonants, glottal activity in whisper, sub glottal pressure measurement

Upper airway dynamics - Constrictors in upper airway, intraoral pressure in vowels and consonants, relationship between velopharyngeal orifice resistance and oral port size, aerodynamics of voiced and voiceless plosives, fricatives, and vowels, effect of velopharyngeal orifice. Methods of measuring lung volume, and intraoral pressure

Instrumentation in speech acoustics and aerodynamics

Data acquisition systems

Acoustic analysis software – Format analysis, LPC analysis, formant tracking, f0 and intensity analysis, spectrography (CSL, SSL, SFS, PRAAT)

Aerodynamic measures – Vitalograph, Aero phone, SPIDA, RMS Spirograph, functioning, method of measurement, normative data and clinical implications

References:

Unit 1

1. Edwards (1992). Applied Phonetics.
2. Ferrand, C T (2007). Speech Science – An integrated approach to theory and practice (II Ed).
3. Fucci & Lass (1999). Fundamentals of speech science
4. Hegde, M N (1991). Introduction to communication Disorders
5. Harris, K S. (1995). Producing Speech: Contemporary Issues.,
6. Kent & Read (2002). The Acoustic Analysis of speech
7. Kent & Read (2002). The Acoustic Analysis of speech
8. Kent, R D (1997). The speech Sciences
9. Ladefoged, P (2001). An Introduction to the Sounds of Languages; Vowels and Consonants,
10. Pickett, J M (1999).The acoustics of speech communication
11. Raphael, Borden & Harris (2007). Speech Science Primer
12. Rosner. B.S.& Pickering. J.B., (1994). Vowel perception and production.
13. Ryalls & Behrans (2000). Introduction to speech sciences- From Basic theories to clinical applications
14. Saito, S (1992). Speech Science & Technology.

Unit 2

1. Ball & Lowry (2001) Methods in Clinical Phonetics
2. Baken, R J & Daniloff, R G.(1991). Readings in Clinical Spectrography. Singular Publishing group, San Diego
3. Hollien, H (2002). Forensic Voice Identification. Academic Press
4. Kent & Read (2002). The Acoustic Analysis of speech
5. Kent, R D (1997). The speech Sciences
6. Ladefoged, P (2001). An Introduction to the Sounds of Languages; Vowels and Consonants,
7. Pickett, J M (1999).The acoustics of speech communication
8. Raphael, Borden & Harris (2007). Speech Science Primer
9. Stevens, K N. (1998). Acoustic Phonetics

Unit 3

1. Barr. R.G., Hopkins. B., Green. J.A., Mackeith Press., (2000). Crying as a sign, a symptom, and a signal:
2. Murry, T. and Murry, J. (1980). Infant communication: Cry and Early speech.
3. Ronald, Brian and James (2000). Crying as a sign, symptom and signal-Clinical, emotional and developmental aspects of infants and toddler crying. Cambridge. University Press.
4. Savithri, S R (2000). Acoustic Analysis of laughter, *Journal of Acoustic Society of India*.

Unit 4

1. Daniloff. (1985) Speech Science: Recent Advances
2. Decker, E N (1996). Instrumentation: Introduction for students in the speech & Hearing Sciences. II ed.
3. Mac Neilage, P F. (1983).The Production of Speech.
4. Seikal (2005). Anatomy & physiology for speech, language and hearing
5. Singh. S. & Singh. K. (2006), Phonetics: principles and practices., IIIrd Edn., Plural Publishing.,
6. Titze, I R.(1994). Principles of voice production
7. Warren, D. W. (1982). In Lass series, Vol 1, Chapter 8, Aerodynamics of Speech.
8. William. J. Barry & Wein. A.Van. (2005.) The integration of phonetic knowledge in Speech Technology.,

Paper Code: AUD 1.5 - SC: Diseases of the ear and auditory pathway: SC

Unit 1

Anatomy – of the external ear, middle ear and inner ear – labyrinth, cochlea, organ of corti, vascular supply of the inner ear, vestibulo cochlear nerve, central auditory pathways and its connection.

Structure and function of nervous system, central and peripheral nervous system, synapse and chemical mediators, circle of willis, cranial nerves, stroke, cerebral palsy, demyelinating disorders, cerebral cortex in hearing, central auditory pathway and its disorders. (to be dealt by Neurologist)

Unit 2

Diseases of the external ear, congenital malformations, injuries, Otitis – externa, Neoplasms of external ear, Wax, Keratosis Obturans, Sebaceous cysts, acquired atresia and stenosis of External auditory canal Diseases of the middle ear cleft, diseases of the Otic capsule- Otosclerosis, congenital malformation, Injuries, Otitis media, Neoplasms, miscellaneous conditions of the Otic capsule- Osteitis deformans, lipid dystrophies, malignant granuloma, epidermoid tumors, reconstruction of middle ear hearing mechanisms. Diseases of the inner ear, congenital deafness, trauma, inflammatory conditions, menieres disease, presbycusis, NIHL, sudden SNHL, CP angle tumors, central deafness, reconstructive and rehabilitation procedures – BAHA and cochlear implants.

Unit 3

Ototoxicity – ototoxic and vestibulo – toxic drugs and its effects on hearing, Anatomical and physiological correlates in ototoxicity, epidemiology and mechanism, Systemic toxicity, Topical toxicity, Interventions, Therapeutic uses of ototoxic drugs and pharmacology related to it, Medico – legal concern.

Unit 4

Medical and Surgical management of problems of hearing and vestibular system

Treatment of ASOM, CSOM – Mastoidectomies and Tympanoplasties -types, Stapedectomy, Cochlear Implants, Endolymphatic sac decompression, Intratympanic entamycin injection, Labrinthectomy, vestibular Neuronectomy, apleys manoeuvre, vestibular rehabilitation exercises.

REFERENCES

- 1.Scott Brown's Text Book of Otorhinolaryngology
- 2.Dhingra Text Book of Otorhinolaryngology
- 3.Log and Turners Text Book of Otorhinolaryngology
- 4.Hazarika Text Book of Otorhinolaryngology
- 5.Zakir Hussaine Text Book of Otorhinolaryngology
- 6.Paparella Text Book of Otorhinolaryngology
- 7.Gerald English Text Book of Otorhinolaryngology
- 8.Introduction to Neurotology by Anirban Biswas
- 9.Electro Nystamography by Milind V. Keethane
- 10.Vertigo and Dysequilibrium by Peter C. Weber
11. Glasscock shambugh surgery of the ear
12. Grays anatomy 39th edition
13. Gyton and hall text book of medical physiology 11th edn.

Paper Code: AUD 1.6 - HCC: Clinical Practicum I

II SEMESTER

Paper Code: AUD 2.1 - HC: Neurophysiology of Hearing

Objectives:

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

1. The different parts of the auditory nervous system and efferent auditory system
2. The functioning of normal auditory nervous system and efferent auditory system
3. The methods used in auditory neurophysiology
4. Give insights into the physiological basis of electrophysiological tests used for hearing assessment
5. Applying the knowledge of auditory neurophysiology to take appropriate clinical decisions

Unit 1 Anatomy & physiology of the auditory nerve & neurotransmitter

- Structure and tonotopic organization of auditory nerve .
- Electrophysiology - Action potential, generation and properties.
- Stimulus coding - frequency, intensity and temporal coding.
- Non-linearity seen at auditory nerve.
- Type of synapse
- Physiology of the nerve
- Neuro-transmitters vs neuro modulator
- Properties and function of neuro transmitter
- Afferent and efferent neuro transmitters

Unit 2: Central auditory pathway

Anatomy of the ascending auditory pathway

- Cochlear nucleus
- Superior olivary complex
- Lateral lemniscus
- Inferior colliculus
- Medial geniculate body
- tonotopic organization at the different levels.

Physiology of the ascending auditory pathway

- Neurophysiology of the central auditory pathway
 - Different types of cell pattern
 - Coding of the stimulus parameters.
 - Coding of the complex acoustic signal
- Response patterns observed at the different levels
- Physiology of sound localization

Unit 3: Auditory Cortex:

- Anatomy and tonotopic organization of the primary and secondary auditory area.
- Classifications of the auditory cortex
- Neurobiological relationship between auditory cortex and other areas
- Neurophysiology of the auditory area.
 - Coding of the stimulus parameters.
 - Coding of the complex acoustic signal
- Vitamins influencing physiology of the auditory nervous system
- Plasticity of the auditory cortex

Unit 4 Anatomy & physiology of the efferent pathway & cranial nerves related to ear

- 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
- Non-classical auditory pathway
- Physiology of the efferent system
- Effect on cochlear physiology and auditory nerve and CN.
- Perception of auditory stimulus.
- Protective function.
- Anatomy of the cranial nerves related to ear.

Reference:

Unit 1

1. The auditory system: anatomy, physiology and clinical correlates. Authors: Frank E. Musiek, Jane A. Baran.
2. Physiology of the ear. By Anthony F. Jahn, Joseph Santos-Sacchi.
3. Hearing: an introduction to psychological and physiological acoustics. Author/s: Gelfand S.A
4. The Mammalian auditory pathway: neuroanatomy: By Douglas B. Webster, Arthur N. Popper, Richard R. Fay.
5. The Mammalian auditory pathway: neurophysiology: By Douglas B. Webster, Arthur N. Popper, Richard R. Fay
6. An introduction to the physiology of hearing: James O Pickels
7. Günter Ehret, R. Romand (1997). The central auditory system. Oxford University Press.
8. Neurobiology of Hearing: Altsucher Richard
9. Enrique A. Lopez-Poveda (2010). The Neurophysiological Bases of Auditory Perception. Springer Link.
10. Adrian Rees, Alan R. Palmer (2010). The Oxford Handbook of Auditory Science: The Auditory Brain. Oxford University Press.
11. David Moore, Alan Palmer, Paul Fuchs (2010). Oxford handbook of auditory science the ear. Oxford University Press

Unit 2

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1. The Mammalian auditory pathway: neuroanatomy: By Douglas B. Webster, Arthur N. Popper, Richard R. Fay.
2. The Mammalian auditory pathway: neurophysiology: By Douglas B. Webster, Arthur N. Popper, Richard R. Fay
3. Physiology of the ear. By Anthony F. Jahn, Joseph Santos-Sacchi.
4. Jeffery A. Winer, Christoph Schreiner (2005). The inferior Colliculus. Springer Link.
5. Lambert M. Surhone, Miriam T. Timpledon, Susan F. Marseken (2010). Superior Olivary Complex. Betascript Publishers.
6. Listening to Speech: auditory perspectives. By Steven Greenberg, William Anthony Ainsworth
7. Speech processing in the auditory system: Steven Greenberg.
8. Enrique A. Lopez-Poveda (2010). The Neurophysiological Bases of Auditory Perception. Springer Link.
9. Neurobiology of Hearing: Altsucher Richard
10. Enrique A. Lopez-Poveda (2010). The Neurophysiological Bases of Auditory Perception. Springer Link.
11. Adrian Rees, Alan R. Palmer (2010). The Oxford Handbook of Auditory Science: The Auditory Brain. Oxford University Press.
12. David Moore, Alan Palmer, Paul Fuchs (2010). Oxford handbook of auditory science the ear. Oxford University Press.
13. Acoustical signal processing in the central auditory system. By Josef Syka

Unit 3

1. Reinhard König (2005). The auditory cortex: a synthesis of human and animal research. Routledge Publishers.
2. Jasper R. Daube, Devon I. Rubin. (2009). Clinical neurophysiology. Oxford University Press.
3. Listening to Speech: auditory perspectives. By Steven Greenberg, William Anthony Ainsworth
4. Speech processing in the auditory system: Steven Greenberg.
5. Enrique A. Lopez-Poveda (2010). The Neurophysiological Bases of Auditory Perception. Springer Link.
6. The Mammalian auditory pathway: neuroanatomy: By Douglas B. Webster, Arthur N. Popper, Richard R. Fay.
7. Physiology of the ear. By Anthony F. Jahn, Joseph Santos-Sacchi.
8. Enrique A. Lopez-Poveda (2010). The Neurophysiological Bases of Auditory Perception. Springer Link.
9. The auditory cortex: structural and functional bases of auditory perception. Lindsay Aitkin.
10. Plasticity and signal representation in the auditory system. By Josef Syka, Michael M. Merzenich.
11. Computational Models of the Auditory System. By Ray Meddis
12. Acoustical signal processing in the central auditory system. By Josef Syka

Unit 4

1. Lambert M. Surhone, Miriam T. Timpledon, Susan F. Marseken (2010). Superior Olivary Complex. Betascript Publishers.
2. The Mammalian auditory pathway: neuroanatomy: By Douglas B. Webster, Arthur N. Popper, Richard R. Fay.
3. The Mammalian auditory pathway: neurophysiology: By Douglas B. Webster, Arthur N. Popper, Richard R. Fay
4. Physiology of the ear. By Anthony F. Jahn, Joseph Santos-Sacchi.
5. The efferent auditory system: basic science and clinical applications. BY Charles E. Berlin.
6. Efferent auditory system: structure and function. By Tony L. Sahley, Richard H. Nodar, Frank E. Musiek.
7. Auditory and Vestibular Efferents. By David K. Ryugo.
8. Acoustical signal processing in the central auditory system. By Josef Syka

Paper Code: AUD 2.2 - HC: Psychophysics of audition

Objectives

1. To familiarize the students with the effect of cochlear hearing loss on various psycho-acoustical tasks.
2. To familiarize the students with various procedures employed for these studies.

Unit 1

Masking and critical band concept – (a) critical band concept (b) masking and excitation pattern (c) non-simultaneous masking (d) frequency resolution (e) tone-on-tone masking (f) relationship between masking level and threshold shift (g) central masking (h) pulsation threshold (continuity effect) (i) two-tone suppression

Unit 2

Adaptation – (a) definition (b) adaptation vs fatigue (c) methods of studying adaptation (d) stimuli parameters affecting adaptation (e) neurophysiological process in adaptation Space perception – (a) binaural hearing (b) localization vs lateralization (c) localization of puretones (d) cues for localization

Unit 3

Localization of complex tones – (a) the acuity of lateralizing transients (b) acuity as a function of frequency (c) onset disparities vs ongoing disparities (d) time-intensity trading (e) binaural adaptation (f) binaural interference

Unit 4

Miscellaneous concepts related to space perception – (a) monaural localization and role of pinnae (b) the cone of confusion and the role of head movements (c) influence of vision on auditory localization (d) perception of distance (e) factors affecting localization (f) clinical application (g) performance in localization and lateralization (h) beats, rotating tones, time separation pitch, time-intensity trade, masking level difference (i) neurophysiological process (j) time-intensity trading (k) sluggishness of binaural system (l) binaural fusion of pulsed stimuli (m) models of binaural hearing (n) JND for dichotic phase. Perception of music – (a) musical scales/musical notes (b) factors affecting perception of music

Psychoacoustic Practicum

- Experiments to study factors/cues in perception of speech sounds.
- MAP/MAF
- Loudness curve/growth function (Magnitude scaling , Cross modality matching), Growth of Masking, temporal masking curves
- Loudness of complex tones
- DLI/DLF
- Temporal integration – matching/ threshold estimation
- Pitch (Mel scale, DLF, Pitch of complex tones)
- Localization : Right & Left localization

References:

Common to all units:

1. Arthur, N. Popper & Richmond, R. Fay (1996). Auditory Computation. (Chapter 6 & 8).
2. Brain, C.J. Moore (1995). Hearing. CA, Academic Press Inc.
3. Brain, C.J. Moore (1986). Frequency Selectivity in Hearing, Academic Press Inc.
4. Brain, C.J. Moore (1998). Cochlear Hearing loss (2nd and 3rd editions): London, Whurr Publishers.
5. David Moore & Plank, (2010). Auditory Science, Hearing. Oxford University Press, USA.
6. Bacon, Fay & Popper. (2003). Compression: From Cochlea to Cochlear Implants. Springer
7. Blauret, J (1996). Spatial Hearing - Revised Edition: The Psychophysics of Human Sound Localization. MIT press.
8. Moore, B. (1996) Perceptual Consequences of *Cochlear Hearing Loss* and their Implications for the Design of Hearing Aids. *Ear and Hearing*. 17(2):133-161.
9. Oxenham, A & Bacon, S (2003). Cochlear Compression: Perceptual Measures and Implications for Normal and Impaired Hearing. *Ear and Hearing*, 24, 350-366.
10. Bramford & Saunders (1994). Hearing impairment ,auditory perception and language disability, New Delhi, Laxman & Chand Arya.
11. Gullick, W.L. (1971). Hearing physiology and psychophysics. New York: Oxford University Press. (Chapters 5, 6, 7 and 9).
12. Bregman, A,S. (1994). Auditory Scene Analysis: The Perceptual Organization of Sound, MIT press.
13. N. Grimault and E. Gaudrain. The consequences of cochlear damages on auditory scene analysis. Current topics in Acoustical Research (Web Ref: http://olfac.univlyon1.fr/unite/equipe-02/grimault-f_fichiers/Grimault-Gaudrain-2.pdf).
14. Jerger, J. (1973). Modern developments in Audiology. New York: Academic Press.
15. Keidel, U.D. and Neff, W.D. (1975). Auditory system in handbook of sensory physiology. Vol.2,
16. Berling: Springer and Verlag. (Chapters 10 and 11).
17. Stanley, A. Gelfand (1998). Hearing. New York: Marcel Dekker Inc.
18. Stuart Rosen and Deter Howell (1991). Signals and systems for speech and hearing. CA: Academic Press Inc. (Chapters 2, 3, 6, 7, 8, 9, 10 and 12).

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19. Tobias, J.V. (1970). Foundations of modern auditory theory. Vol. I New York: Academic Press.
20. Tobias, J.V. (1983). Foundations of modern auditory theory. Vol. II New York: Academic Press.
21. Willam, A. Yost (1994). Fundamentals of hearing (all editions). CA: Academic Press Inc.

Paper Code: AUD 2.3 - HC: Electrophysiological Assessment of the Auditory System

Objectives:

After completion of this course, candidate should be able to

1. List different auditory evoked potentials (AEPs) and their generators
2. Describe general principles in recording various AEPs
3. Independently decide the need for recording a particular AEP in the clinic
4. Explain clinical applications of various auditory evoked potentials
5. Independently set the parameters for recording various AEPs
6. Independently record and interpret various AEPs

Unit 1

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

Unit 2

- a) Factors affecting recording and interpretation of early responses (including Ecochg, ABR)
 - Subject variables
 - Stimulus variables
 - Recording variables
- b) Clinical application of early responses

Unit 3

- I. a) Factors affecting recording and interpretation of middle latency response
 - Subject variables
 - Stimulus variables
 - Recording variables
- c) Clinical applications of MLR

- II** a) Factors affecting recording and interpretation of long latency response
- Subject variables
 - Stimulus variables
 - Recording variables
- b) Clinical applications of LLR

Unit 4

- I** a) Factors affecting recording and interpretation of endogenous potentials such as P300, MMN, CNV.
- Subject variables
 - Stimulus variables
 - Recording variables
- b) Clinical applications of endogenous potentials
- II** a) Factors affecting recording and interpretation of steady state evoked potentials
- Subject variables
 - Stimulus variables
 - Recording variables
- b) Clinical applications of SSEPs

References:

Unit 1:

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. Hall, J.W. (1992). Handbook of Auditory Evoked Responses. Massachusetts: Allyn and Bacon.
4. Hall, J.W. (2007). New Handbook of Auditory Evoked Responses, Boston, Pearson
5. Hall, J.W. and Mueller, H.G. (1997) Audiologists' Desk Reference Volume 1: Diagnostic Audiology Principles, Procedures and Protocols, Singular Publishing Group: San Diego.
6. Hood, L.J. (1998). Clinical applications of auditory brainstem response. San Diego: Singular Publishing Group, Inc.
7. Jacobson, J.T. (Ed). (1985). Auditory Brainstem Response. London: Taylor and Francis.
8. Jacobson, J.T. (Ed). (1994). Auditory Brainstem Response. London: Taylor and Francis.
9. Katz, J. (Ed.). (1994). Handbook of Clinical Audiology. Baltimore: Williams and Wilkins.
10. McPherson, L.D. (1995) Late potentials of the auditory system, London: Singular Publishing Group.

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11. Rance, G (Ed) (2008), The Auditory Steady-State Response: Generation, Recording, and Clinical Application, SanDiego, Plural Publishing.
12. Roser ,R.R., Valente, M & Hosford-Dunn, D (Eds) (2000). Audiology: Diagnosis, New york, Thieme.

Unit 2:

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. Massachussetts: Allyn and Bacon.
3. Hall, J.W. (2007). New Handbook of Auditory Evoked Responses, Boston, Pearson
4. Hall, J.W. and Mueller, H.G. (1997) Audiologists' Desk Reference Volume 1: Diagnostic Audiology Principles, Procedures and Protocols, Singular Publishing Group:San Diego.
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.

Unit 3:

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. Massachussetts: 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.

Unit 4:

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. Massachussetts: Allyn and Bacon.
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4. Jacobson, J.T. (Ed).(1985). Auditory Brainstem Response. London: Taylor and Francies.
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6. Katz, J. (Ed.). (1994). Handbook of Clinical Audiology. Baltimore: Williams and Wilkins.
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8. Rance, G (Ed) (2008), The Auditory Steady-State Response: Generation, Recording, and Clinical Application, SanDiego, Plural Publishing.
9. Roser ,R.R., Valente, M & Hosford-Dunn, D (Eds) (2000). Audiology: Diagnosis, New york, Thieme.

Paper Code: AUD 2.4 SC: Vestibular system: assessment & management

Objectives:

- To apply information regarding the vestibular system in Audiological practice

Unit 1

Anatomy and physiology of vestibular system
Anatomy of central vestibular path way and its connections

Unit 2

Systems involved in balance disorders – Ocular system, sensory and proprioception receptors, cerebellum and its central connections, systemic and neurological disorders involving these systems.

Unit 3

Diseases of vestibular nerve, schwannomas, patho physiology of the diseases
Involving peripheral and central vestibular disorders, BPPV, evaluation of the vestibular system.

Unit 4

History taking in vertigo patients
Clinical test in balance disorders
ENG – procedure and clinical implication
Medical management and rehabilitation of vertigo patients

References:

1. Scott Brown's Text Book of Otorhinolaryngology
2. Dhingra Text Book of Otorhinolaryngology
3. Log and Turners Text Book of Otorhinolaryngology
4. Hazarika Text Book of Otorhinolaryngology
5. Zakir Hussaine Text Book of Otorhinolaryngology
6. Paparella Text Book of Otorhinolaryngology
7. Gerald English Text Book of Otorhinolaryngology
8. Introduction to Neurotology by Anirban Biswas
9. Electro Nystamography by Milind V. Keethane
10. Vertigo and Dysequilibrium by Peter C. Weber
11. Glasscock shambugh surgery of the ear
12. Grays anatomy 39th edition
13. Gyton and hall text book of medical physiology 11th edn.

Paper Code: AUD 2.4 - SC: *Clinical Neuropsychology*

Objectives

- To prepare students in the specific area of neuropsychology as a discipline seeking to understand brain-behavior relationships in the context of disorders in human communication.
- To train students into skills and competencies required for incorporating the dimension of clinical neuropsychology in their practice for identification and management of communication disorders
- To sensitize pupils on the ethical aspects of neuropsychological assessment and rehabilitation when dealing with communication disorders in special populations of individuals like children with special needs, brain-injured adults and the elderly.
- To develop acumen for integrating neuropsychological perspective in the field of research in communication disorders.

COURSE CONTENT

Unit 1

- Clinical Neuropsychology: Meaning, Definition, History, & Applications to Contemporary trends in understanding brain behavior relationships – Methods of Study: Ablation Studies – Split Brain -
- Basics of Neuroanatomy and Neurophysiology: Nervous System - Structure and Functions – Divisions of Cortical Sub-Cortical Regions
- Neural Connectivity, Conduction and Synaptic Transmission - Localization and Lateralization of Brain Functions: Lobe & Hemispheric Functions -Plasticity of Functions
- Overview of Organic Brain Syndromes: Dementias, Organic Psychoses, Convulsion Disorders & Degenerative Conditions

Unit 2

- Clinical Neuropsychological Assessment: Meaning and Approaches – Fixed and Flexible Battery Approaches – Need and Purpose of Assessment – Changing Scenario of Clinimetry: Issues and Problems
- Ethical Issues in Assessment of Children and Elderly
- Test Battery Approaches: LNNB and HRNTB – Adult and Child Versions; Geriatric Neuropsychology:
- Indian Scales: AIIMS Neuropsychological Test Battery, NIMHANS Neuropsychological Test Battery and Functional Neuropsychological Assessment Battery – Structure and Observation of Clinical Testing

Unit 3

- Clinical Neuropsychological Assessment & Profiling of Adults and Children: RINTB - Case Study – Progress and Problems in Child Neuropsychology
- Assessment of Cognition – Tests of Attention/Concentration; Memory, Thinking and Intelligence - Clinical Mental Status Examination of Neuropsychological Functions
- Contemporary Brain Imaging Techniques & Electrophysiological Methods: EMG – GSR - fMRI - CT - EEG - MEG - CBF - PET - Ablation Studies - Split Brain Research - Dichotic Listening – Clinical Case Studies - Lesion Studies; Functional Behavioral Profiling

Unit 4

- Neuro-rehabilitation: Meaning, Purpose and Theories - Plasticity of Brain Functions; Functional Adaptation; and Artifact Theories - Meaning, Approaches and Techniques: Remediation, Compensation and Adaptive – Measuring Efficacy and Outcomes
- Attention and Memory Retraining Programs – Use of External Aids – Awareness Training – Working with Families - Variables in Neurobehavioral Recovery: Demographic Variables – Injury related variables – psychological factors – Neuro-plasticity and Synaptic Reorganization – Factors in Training Program
- Neuropsychology of learning disabilities, mental retardation and related developmental disabilities – Implications for Assessment and Remediation

References:

Unit 1

1. Bloom, F. & Lazeron, A. (1996). *Brain, mind, and behavior* (2nd ed.). New York: Freedman.
2. Kolb, B. & Whishaw, I.Q. (1996). *Fundamentals of human neuropsychology* (4th ed.). New York: Freeman Press.
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1. Ferraro, F.R. (Ed.) (2001). *Minority and cross-cultural aspects of neuropsychological assessment*. Lisse, Netherlands: Swets & Zeitlander Publishers.
2. Grant, I. & Adams, K. (1996). *Neuropsychological assessment of neuropsychiatric disorders*. New York: Oxford University Press.
3. Lezak, M.D. (1995). *Neuropsychological Assessment* (3rd ed.). Oxford University Press: New York.
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7. Tramontana, M.G., and Hooper, S.R. (1995). *Advances in Child Neuropsychology*. New York: Springer-Verlag.

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1. Caley, A. (1999). *Assessment of Neuropsychological Functions in Psychiatric Disorders*. New York: American Psychiatric Publishing.
2. Lezak, M., Loring, D.W., and Hannay, H.J. (2004). *Neuropsychological Assessment*. Fourth Edition. New York: Oxford University Press.
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4. Schoenberg, M.R. and Scott, J.G. (Eds.). (2011). *The little black book of Neuropsychology.: A Syndrome based Approach*. New York: Springer-Verlag.

Unit 4

1. Sohlberg, M.M., and Mateer, C.A. (2001). *Cognitive Rehabilitation: An Integrative Neuropsychological Approach*. New York: The Guilford Press.
2. Banks, M. E. & Ackerman, R. J. (1997). *Ethnogeriatric issues in neuropsychological assessment and rehabilitation, Topics in Geriatric Rehabilitation, 12, 47-61.*

Paper Code: AUD 2.4 - SC: *Clinical Behaviour analysis*

Objectives

- To prepare students in the specific area of clinical behavior analysis, therapy or change programs for affected individuals with disorders in human communication.
- To train students into practical skills and competencies required for mastering basics of clinical behavior analysis in their practice for identification and management of persons with communication disorders
- To sensitize pupils on the ethical aspects of clinical behavior analysis when dealing with individuals or their families with communication disorders.
- To develop ability for integrating clinical behavior analysis and counseling based aspects in the field of research in communication disorders.

COURSE CONTENT

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

References

Unit 1

1. Theoretical and experimental bases of the behavior therapy, by Feldman et al, Wiley, London.
2. Clinical biofeedback by Kenneth, R.G. Williams and Williams, Baltimore.
3. Behavior analysis and treatment by Ron Van Houten et al, Plenum press, NY, 1993.
4. Handbook of cognitive behavior by Keith S. Dobson, Hutchinson, London, 1988.
5. Annual review of behavior therapy: Theory and Practice by Franks & Wilson, 1997.
6. Behavior modification for people with mental handicap by Yule W. Carr J., Croon Helm Ltd., London, 1974.
7. International handbook of behavior modification and therapy by Alan S. Bellack et al, Plenum Press, NY, 1985.

Unit 2

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Unit 4

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2. Di Franco, Joyce T. "Biofeedback." In *Childbirth Education: Practice, Research and Theory*, edited by F. H. Nichols and S. S. Humenick. 2nd ed. Philadelphia: W. B. Saunders, 2000.
3. Schwartz, Mark S. and Associates. *Biofeedback: A Practitioner's Guide*. New York: Guilford, 1987.
4. Spencer, John W. and J. J. Jacobs. *Complementary/Alternative Medicine: An Evidence-Based Approach*. Baltimore: Mosby, 1999.
5. Stoyva, Johann M. and Thomas H. Budzynski. "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. 2nd ed. New York: Guilford Press, 1993.

Paper Code: AUD 2.5 - OE: Early Identification of Hearing Impairment

Objectives:

After studying this paper, the student teachers are expected to realize the following objectives:

1. Importance of prevention and early identification of hearing impairment
2. Ways to prevent hearing impairment
3. Ways to identify hearing impairment at early stage
4. Different test involved in hearing screening
5. Importance of early rehabilitation and need for auditory training
6. Counseling and need for appropriate referrals

Unit 1: Role of hearing and causes

- 1.1 Different terminologies and definition of hearing loss
- 1.2 Ear mechanism and physical attributes of sound
- 1.3 Role of hearing, classification of hearing impairment and causes
- 1.4 Development of human auditory system and auditory behavior

Unit 2: Need for prevention and early identification of hearing impairment

- 2.1 Important and need for prevention of hearing impairment
- 2.2 Different levels of prevention
- 2.3 Different measures involved in prevention of hearing impairment
- 2.4 Meaning and relevance of early identification
- 2.5 Critical age concept and sensitivity period for language acquisition

Unit 3: Tests for early identification of hearing impairment

- 3.1 Informal tests procedure (Case history, behavioral observation)
- 3.2 Formal tests procedure (HRR, behavioral observation, Screening OAE, Screening ABR)
- 3.3 Individual and group screening / Mass media screening tests
- 3.4 Diagnostic test procedure including Electrophysiological tests (Stimuli, procedures, recording of response)
- 3.5 Interpretation of the test results, Validation and referrals

Unit 4: Need early intervention of hearing impairment

- 4.1 Counseling and referral for therapeutic management
- 4.2 Role of involvement of each team members
- 4.3 Scope and rational of auditory training
- 4.4 Different approaches and goals of auditory training

References:

Unit 1

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Unit 2

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2. Rajveev. J, Aparna. N, & Anuradha. B (2006). Introduction to hearing impairment, DSE (HI) Manual.

Unit 3

1. Gerber, S.E., and Mencher., S.T. (1978). Early diagnosis of hearing loss, New York, Grune and Stratton.
2. Maryanne T. T & Pamela. K (2000). Audiology: An Introduction for teachers and other professionals, London.

Unit 4

1. Auditory Verbal Therapy for parents and professionals –Warren Estabrooks- 1994 – Alexander Graham Bell Association for the deaf and Hard of Hearing – Washington D.C. U.S.A
2. Erber, N.P. (1982), Auditory Training, Washington: A.G. Bell Association for deaf.
3. Flexer C., (1994). Facilitating Hearing and Listening in Young children. California: Singular Publishing Inc.
4. Foundations of spoken language of Hearing Impaired children.– Daniel Ling -1988 - Alexander Graham Bell Association for the deaf and Hard of Hearing – Washington D.C. U.S.A
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6. Sanders, D. A. (1993). Management of hearing handicap: Infants to elderly. 3rd Ed. New Jersey: Prentice Hall.

Paper Code: AUD 2.5 - OE: Calibration of Diagnostic equipments for Audiology

Objectives:

- a) To understand and observe the principle of working and functioning of equipments used for measurement of sounds and calibration of diagnostic equipments.
- b) To understand the structure and functioning of all types of transducers used in diagnostic audiology and learn the procedure for estimating their electro acoustic parameters.
- c) To learn practically the procedure for calibration of audiometers, middle ear analyzer, Otoacoustic emission analyzer and BERA.
- d) To understand the national and international standards for hearing aids and learn about all electro acoustic parameters.
- e) To learn practically the procedure for electro acoustic evaluation of all parameters of hearing aids.

Unit 1: Introduction to Transducers, their performance and need for calibration

Basic structure and functioning of :

- a) Microphones- carbon, piezo electric, ribbon, moving coil, condenser and electrets
- b) Headphones- circumaural and supraaural types
- c) Insert Receivers
- d) Loudspeakers- woofer, squalker, tweeter etc.
- e) Bone Vibrators

Characteristics of transducers

Factors affecting the performance of transducers

Checking of transducers and connecting cables

Need for calibration of equipments

Unit 2: Equipments for calibration

Microphones – pressure field, free field, diffused field

Pre amplifier and extension cable

Artificial ear

Artificial Mastoid

Couplers – 6 cc, 2 cc and HA2

Adaptors

Sound level meter

Sound level calibrator

Digital Storage Oscilloscope

Interconnecting of equipments

Care and maintenance of devices and equipments used for calibration.

Unit 3: Calibration of Diagnostic Audiology Instruments

Block diagram, functional description, equipment setup and calibration procedure for :

- a) Audiometer
- b) Middle ear Analyzer
- c) Otoacoustic Emission Analyzer
- d) BERA

International Standards (ISO/ANSI/IEC) and procedures for calibration

Unit 4: Electro acoustic evaluation of hearing aids and audiometric transducers

Setup for Electro acoustic evaluation of audiometric transducers

Parameters for Electroacoustic evaluation of audiometric transducers and their measurement procedure

Setup for Electro acoustic evaluation of hearing aids

Parameters for electro acoustic evaluation of hearing aids and their measurement procedure

Hearing aid analyzer – Setting up, measurement, interpretation of results

National and International standards for hearing aids

References:

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Ltv. Research Centre
Powell, J.G., Van Houten, J.J.
2. Architectural Acoustics
Bruel & Kjaer
Ginn, K.B.
3. Handbook of Acoustics
John Wiley and Sons
Malcoem J. Crocker
4. Principles and Applications in Auditory Evoked Potentials
Allyn and Bcon
Jacobson, John T. J.
5. Handbook of Clinical Audiology
Lipincott Williams and Wilkins 6th Ed.
Jack Katz.
6. Science of Sound
Addison Wesley 3rd Ed.
Richard Moore, Ruossing, Thomas D.
Wheeler Paul A.
7. Encyclopedia of Acoustics
John Wiley and Sons
Crocker, Malcoem J.

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 different levels of signal processing strategies used in different types of hearing aids.
- c) To learn the various signal processing strategies used in hearing aids - amplification, noise reduction, channel based gain and output control.
- d) To understand and observe the effects of signal processing strategies and their impact on natural quality of sound and their influence on spectral and temporal characteristics.
- e) To learn practically the procedure for electroacoustic evaluation of hearing aids.
- f) To learn practically how to setup and use the system for analysis of hearing aid output

Unit 1: Introduction to Hearing aid components – Their structure and principle of operation

- a) Microphone
- b) Telecoil
- c) Amplifier
- d) Receiver
- e) Volume control, OTM switch, output control, other trimmer controls etc.
- f) Battery – Various types and their characteristics
- g) Chords, ear hooks, connecting tube etc.

Block diagram of analog and digital hearing aids

Programming setup of hearing aids

Additional features available in hearing aids

Unit 2: Introduction to Digital signal processing

Block diagram of a digital signal processing system

Principle and Functioning of Analog to Digital converter and Digital to Analog converter

Fundamental concepts of Digital Signal Processing - Decomposition, Processing and Synthesis Implementation of filters using DSP

Implementation of Amplifiers using DSP

Basic technique of amplitude and frequency modulation

Unit 3: Signal processing in Hearing aids

- a) Signal processing techniques in channel separation, non-linear amplification, output limiting, noise reduction, feedback cancellation etc.
- b) Microphone technology and noise reduction through microphone technology
- c) Techniques of nonlinear amplification – Input compression, output compression, BILL, TILL, WDRC, compression parameters etc.

Unit 4: Objective studies on hearing aids

- a) Electroacoustic parameters of hearing aids – National and International Standards
- b) Equipment setup for objective studies of hearing aids
- c) Equipment setup and techniques for measurement and analysis of temporal parameters of hearing aids.
- d) Equipment setup and techniques for measurements and analysis of spectral parameters
- e) Introduction to Matlab, how to use Matlab effectively for objective studies on hearing aids.

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- | | |
|--|---|
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Delmar Cengage Learning
Jeffrey J. DiGiovanni | 2. Handbook of Acoustics
John Wiley and Sons
Malcoem J. Crocker |
| 3. Textbook of Hearing Aid Amplification
Singular Publishing Group 2 nd Ed.
Robert E. Sandlin | 4. Handbook of Hearing Aid
Amplification
Singular Publishing Group
Robert E. Sandlin |
| 5. Handbook of Clinical Audiology
Lipincott Williams and Wilkins 6 th Ed.
Jack Katz. | 6. Science of Sound
Addison Wesley 3 rd Ed.
Richard Moore, Ruossing, Thomas D.
Wheeler Paul A. |
| 7. Introduction to Digital Signal
Processing
Prentice-Hall of India Pvt., Ltd.,
Johnson, Johnson R. | 8. Applications of Digital Signal
Processing to Audio and Acosutiacs
Kulwer Academic Publishers
Brandenburg, KerlheinZ |
| 9. Cochlear Implants
Springer
Richard R. Fay, Popper, Arthur N.
Zeng, Fan Gang | |

Paper Code: AUD 2.6 - HCC: Clinical Practicum I

Paper Code: AUD 2.7 - SC: Clinical Counselling

- Guidance for Parents/Caregivers on Available Benefits/Concessions for Differently Abled
- 3-5 Sessions on counseling siblings and/or grandparents on chosen themes of family or individual conflict areas
- Diagnostic counseling for communicating details on or about an individual clients condition to parents or significant others
- Behavioral counseling on home management of PWD/CSN

Paper Code: AUD 2.7 - SC: Repair of Hearing Devices

- Identifying components of hearing devices
- Repair of hearing devices based on troubleshooting results

SEMESTER III

Paper Code: AUD 3.1 - HC: Psychophysics of Audition in Hearing Impaired

Objectives:

1. To Familiarize the students with the effect of Cochlear hearing loss on various psycho-acoustical tasks
2. To Familiarize the students with various procedures employed for these tasks

Unit 1

- 1. Threshold detection-psychometric function**
- 2. Frequency Selectivity**
 - a. Simultaneous masking
 - b. Non-simultaneous masking
 - c. Basilar membrane input/output function
 - d. Clinical Applications

Unit 2

- 1. Loudness**
 - a. Loudness perception in hearing impaired
 - b. Recruitment & Dynamic Range
 - c. Loudness adaptation
 - d. Difference limen for Intensity
- 2. Pitch Perception**
 - a. Perception of Pitch in hearing impaired
 - b. Difference limen for frequency
 - c. Perception of pitch of complex tones
- 3. Clinical Applications**

Unit 3

- 1. Masking**
 - a. Masking and Threshold shift in hearing Impaired
 - b. Forward masking and Backward masking
 - c. Central Masking
 - d. Informational masking

2. Temporal Processing

- a. Temporal resolution: Gap detection, TMTF
- b. Temporal Integration
- c. Acoustic Temporal Order
- d. Auditory numerosity

3. Clinical Applications

Unit 4

a. Binaural Hearing

- I. Binaural Hearing in Hearing impaired
- II. Temporal Dimension of Binaural Hearing
- III. Factors affecting binaural hearing in Hearing impaired

b. Auditory object Perception in hearing Impaired

- a. Spectral Suppuration
- b. Spectral profile
- c. Harmonicity/ Temporal regularity
- d. Spatial suppuration
- e. Temporal Suppuration
- f. Temporal Onset and Offset
- g. Temporal Modulation

References:

1. Arthur, N. Popper & Richmond, R. Fay (1996). Auditory Computation. (Chapter 6 & 8).
2. Brain, C.J. Moore (1995). Hearing. CA, Academic Press Inc.
3. Brain, C.J. Moore (1986). Frequency Selectivity in Hearing, Academic Press Inc.
4. Brain, C.J. Moore (1998). Cochlear Hearing loss (2nd and 3rd editions): London, Whurr Publishers.
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18. Stuart Rosen and Deter Howell (1991). Signals and systems for speech and hearing. CA: Academic Press Inc. (Chapters 2, 3, 6, 7, 8, 9, 10 and 12).
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Paper Code: AUD 3.2 - HC: Implantable Devices for Persons with Hearing Impairment

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

- To identify, describe the types of implantable devices and tell the purpose(s) of each component used in implantable devices.
- To select candidates for implantable devices
- To assess the benefit from implantable devices

Unit 1

Implantable hearing aids (partial and total implantable hearing aids)

a) Bone anchored hearing aids (BAHA)

- History
- Candidacy
- Components
- Types
- pre- post operative evaluation
- Assessment of benefit
- Care and maintenance/Trouble shooting of the device

b) Middle ear implants

- History
- Candidacy
- Components
- Types
- pre- post operative evaluation
- Assessment of benefit
- Care and maintenance/Trouble shooting of the device

Unit 2

Cochlear implants

- History
- Biological safety
- Candidacy – pre-operative evaluation for children and adults
- Surgical procedures in brief
- Components and terminology
- Types – design and features
- Electrical near field recording (NRT), electrical stapedial reflex threshold (E- SRT) and others.
- Evaluation of benefits
- Bilateral implants, hybrid implants, bimodal implants.
- Optimization of hearing aid in the contralateral ear for bimodal implants.
- Contraindication for CI
- Complications and immunization

Unit 3

- a) Other implantable devices (Brainstem implant, Midbrain implants)
- Candidacy – pre-operative evaluation for children and adults
 - ABI/MBI team
 - Surgical procedures in brief
 - Components and terminology
 - Types – design and features
 - Evaluation of benefits
- b) Current trends and future needs in implantable devices

Unit 4

Post implant considerations for implantable devices

- (a) Speech processor and strategies
- (b) Post – operative mapping, use of physiological/ electrophysiological measures (EABR, ESRT)
- (c) Psychophysics of implants – threshold, intensity discrimination, loudness perception, loudness growth, loudness adaptation, loudness summation, pitch discrimination, gap detection, frequency resolution, temporal integration, masking, binaural phenomenon.
- (d) Counselling: Pre-implant and post-implant; Care and maintenance/ trouble shooting of CI, ABI, MBI
- (e) Loans, insurance, warranty, schemes, FDA approval regarding implantable devices.
- (f) Deaf culture and its impact in the society

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Unit 1

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2. J-I Suzuki, Tokyo (1988). Advances in audiology- Middle ear implant: Implantable hearing aids. Switzerland: Karger.
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2. Clark. G., Tong. Y.C., & Patrick. F.J (1990). Cochlear Prostheses. Edinburgh London Melbourne & New York. Churchill 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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8. Niparko JK, Kirk KI, Mellon NK, Robbins AM, Tucci DL, Wilson BS, editors. Cochlear Implants: Principles and Practices. Philadelphia: Lippincott Williams & Wilkins; 2000.
9. Tyler. R.S. (1995). Cochlear implants: Audiological foundations. New Delhi: AITBS Publishers.
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1. Allum, D.J., ((1996). Cochlear implant rehabilitation in children & Adults. London: Whurr publishers Ltd.
2. C.S. Kim, S.O. Chang &D.Lim (2000). Updates in cochlear implantation. Switzerland: Karger.
3. Clark. G., Tong. Y.C., & Patrick. F.J (1990). Cochlear Prostheses. Edinburgh London Melbourne & new York. Churchill Living stone.
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9. Waltzman, S.B & Cohen, N.L (2000). Cochlear implants. New York : Thieme Medical Publishers.
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Paper Code: AUD 3.3 - 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. Explain infant and animal speech perception

Unit 1

- a) Coding of speech in the auditory pathway
 - Coding in the cochlear and auditory nerve
 - Coding in the central pathway
- b) Normalization in speech perception
 - Definition
 - Methods used for normalization of vowels and consonants
- c) Categorical perception
 - Definition
 - Evidence for and against categorical and continuous speech perception
- d) Theories of speech perception
 - Acoustic theory
 - Neurological theory
 - Auditory theory
 - Motor theory
 - Analysis by synthesis

Unit 2

- a) 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
- b) Perception of consonants in normals:
 - Major and minor cues to identify place, manner and voicing in:
 - Stops
 - Fricatives
 - Affricates
 - Nasals

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- Major and minor cues to differentiate between Stops, Fricatives, Affricates, Nasals
- Acoustical parameters used to differentiate vowels from consonants

Unit 3

- a) Methods used to study speech perception
 - Analysis by synthesis
 - Parametric synthesis
 - Articulatory synthesis
- b) Effects of co-articulation on speech perception:
 - Perception of vowels from consonantal segmental cues
 - Perception of consonants from vowel segmental cues

Unit 4

- a) Short term memory and speech perception
 - Stages of memory and coding at the different stages
 - Theories of short term memory
 - Perception of consonants and vowels in short term memory
 - Differences in the perception of consonants and vowels in short term memory
- b) Dichotic listening
 - Theories
 - Factors affecting dichotic perception
 - Stimulus parameters
 - Procedure parameters
 - Subject parameters
 - Application in the field of speech and hearing
- c) Infant perception
 - Methods of studying infant speech perception
 - Advantage of one method over the other
 - Theories of infant perception
 - Studies to support the theories
 - Perception of consonants and vowels in infants
 - Comparison of adult and infant perception
- b) Animal speech perception
 - Need to study animal speech Perception of consonants and vowels
 - Categorical perception
 - Animal Vs. human perception

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Paper Code: AUD 3.4 - HC: Seminars in Assessment of Hearing Impairment

Objectives:

- 1) List behavioral indications of disorders peripheral and central auditory system
- 2) Choose appropriate test battery for different disorders
- 3) Correlate audiological test findings and radiological findings
- 4) Counsel the clients on the findings, pathophysiology, probable cause and appropriate management

Unit 1

Correlation of audiological (and non-audiological wherever necessary) findings to histopathological findings in Conductive hearing loss

Unit 2

Correlation of audiological (and non-audiological wherever necessary) findings to histopathological findings in

- a) Cochlear pathology
- b) Retro-cochlear pathology

Unit 3

Assessment of auditory disorders in the special population such as Deaf-blind, MR, Autism, Cerebral palsy and others

Assessment of patients with hyperacusis

- a) condition/disorders in which it occurs
- b) tests, interpretation
- c) implications of findings in rehabilitation

Assessment of patients with Vestibular problems

- a) condition/disorders in which it occurs
- b) Tests, interpretation
- c) implications of findings in rehabilitation

Assessment of patients with Tinnitus

- a) Condition associated with tinnitus
- b) Types of tinnitus
- c) Evaluation
- d) Implications of findings in rehabilitation

Unit 4

Genetic hearing loss

- a) Basics of Genes and genetic hearing loss
- b) Audiological and non-audiological tests for identifying genetic hearing loss,
- c) Gene mapping, amniocentesis
- d) Gene therapy
- e) Genetic counselling

Non-audiological tests

- a) Clinical neurological examination
- b) X-rays, PET, MRI, fMRI, CT Scan and other tests
- c) Lab tests for differential diagnosis of auditory disorders

Reference:

Unit 1

- R. Sataloff and Sataloff (1993), Hearing Loss, Informa Health Care
- Hall, J.W. and Mueller, H.G. (1997) Audiologists' Desk Reference Volume 1: Diagnostic Audiology Principles, Procedures and Protocols, Singular Publishing Group: San Diego.
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- Richard S. Tyler (2000). Tinnitus Handbook. CA: Singular Publishers
- Luxon, L.M. and Davies, R.A. (Eds.) (1997). Handbook of vestibular rehabilitation. San Diego: Singular Publishing Group, Inc.
- Desmond, A L. (2004). Vestibular function assessment and management, NY:Theime publishers
- Highstein, S M, Fay, R R., & Popper, A N. (2004). The vestibular system, Springer Series
- Weber, P C. (2008). Vertigo and disequilibrium, NY: Theime Publishers
- Vernon, J. A. (1998). Tinnitus: Treatment and Relief. Boston: Allyn and Bacon
- Gary P. Jacobson, Neil T. Shepard. (Ed) (2008). Balance function assessment and management. San Diego: Plural Publishing Inc.

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- Kingsley, R.E. (1996). Concise text of neuro science. Philadelphia: Williams and Wilkins.
- Martini, A, et al (Eds) (1996) Genetics and Hearing impairment, London: Whurr Publishers
- Shprintzen, R.J. (1997). Genetic, Syndromes and communication disorders. San Diego: Singular Publishing Group, Inc.

Paper Code: AUD 3.5 - HC: Seminars in Rehabilitative Audiology

Objectives: At the end of the course, the student shall

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

Unit 1 Advances in rehabilitation

- a) Application of Digital / programmable technology in amplification devices.
 - Hearing aids
 - Assistive Listening Devices (ALDs)/Hearing assistance technology.
- b) (i) Amplification and signal enhancing techniques with reference to psychophysical aspects of hearing.
 - (ii) Speech cue enhancement – spectral shape, duration, intensity, speech simplification, re-synthesis, technology to improve SN ratio, frequency response, etc.
 - (iii) Techniques to control acoustic feedback, distortion, circuit noise.
 - (iv) Electromagnetic interference – measurement, solutions.
- (c) Application of LASER technology in ear mould production, ear mould modifications; application of nanotechnology in hearing aids
- (d) Hair cell regeneration, gene therapy for hearing loss, auditory deprivation, toughening, genetic counseling

Unit 2 Electroacoustic measurement of hearing aids

- (a) Electroacoustic performance of hearing instruments and ALDs.
 - Instrumentation, sound field equalizing methods.
 - Electroacoustic measurements of digital hearing aids including phase and group delay and ALDs.
 - Variables affecting electroacoustic measurements.
 - International and Indian standards for EAM of hearing aids and ALDs.
- (b) Cerumen management
- (c) Current and future trends in technology and fitting of hearing aids and ALDs/HATs

Unit 3 Hearing aid fitting

- (a) Selection, verification and validation of hearing aids and ALDs.
 - Listening needs of the individuals with hearing impairment
 - Overview and evaluation of hearing aid selection procedures
 - Objective procedures for hearing aid selection (ABR, ALLR, ASSR and others)

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- Insertion gain measurement, sound field measurement
- Hearing aid fitting for children
- Management of sudden hearing loss, cochlear dead region/auditory dysynchrony, vestibular problems, APD.
- Outcome measures, handicap measures.
- Fitting of ALDs
- Future trends in hearing aid fitting strategies

b) Aural rehabilitation and effective counseling for:

- Digital hearing aids and ALDs
- Care and maintenance of hearing devices for pediatric and adults
- Trouble shooting of hearing aids/ ALDs
- Genetic counselling

Unit 4 Rehabilitation of individuals with hearing impairment

- (i) Early identification and intervention programs
 - Designs and evaluation of the programs executed in different countries.
 - Criteria to select method of rehabilitation
 - Auditory training and auditory learning methods; Auditory verbal therapy; psychophysical aspects in rehabilitation
 - Language training for different age groups
 - Psychosocial aspects in rehabilitation
 - Auditory plasticity
- (ii) Educational facilities in India - Preschool, School, college and vocational training
 - Formal and informal education
 - International and national policies/acts related to educational facilities (Biwako millennium framework, Salamanca statement, DPEP scheme, PWD act, UNCRPD)
 - Measures to implement these policies/acts in India.
 - Audit facilities in India
- (iii) Rehabilitation of geriatrics
 - Listening training, speech reading, speech/discourse tracking
 - Communication strategies
 - Assertiveness training
- (iv) Strategies for management of the children/adult with multiple handicapped
 - Hearing impairment with visual problems.
 - Hearing impairment with cognitive problems
 - Hearing impairment with neuro – motor problems
- (v) Audiological management of tinnitus and hyperacusis
 - Models related to tinnitus management - patho/neuro physiological model
 - Management techniques for normal hearing and different degrees of hearing loss (Masking, TRT, Counselling, others)
 - Management outcomes.

Reference:

Unit 1

1. Moser. P. J (2009). Electronics and Instrumentation for Audiologists. Unites States of America: Taylor & Francis Group.
2. Sandlin. R.E (2000). Textbook of Hearing aid amplification. London: Singular Publishing Group.
3. Schaub. A (2008). Digital hearing aids. NewYork: Thieme Medical publishers.
4. Tyler. R.S & Schum. .J (1995). Assistive devices for persons with hearing impairment. United states of America: Allyn & Baccon.
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2. Cole. E.B & Carol. F (2007).Children with hearing loss- Developing Listening & Talking. United States of America; Plural Publishing Inc.
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5. Hogan. A (2001). Hearing Rehabilitation for deafened adults. London & Philadelphia: Whurr Publishers.
6. Jastreboff. P.J & Hazell.J.W.P (2004). Tinnitus retraining therapy-implementing the Neurophysiological model. United Kingdom; Cambridge University Press.
7. Kriscos, P.B & Lesner. S.A (1995). Hearing care for the older Adult-Audiologic rehabilitation. United States of America: Butterworth-Heinemann.
8. Pedley, Giles & Hogan (2005). Adult cochlear implant rehabilitation. London & Philadelphia: Whurr publications.
9. Roeser. R.J & Downs. M.P (2004). Auditory disorders in school children. Newyork: Thieme Medical Publishers,Inc.
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Paper Code: AUD 3.6 - HCC: Clinical Practicum I

Paper Code: AUD 3.7 - HC: 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 (C) APD and explain their physiological bases
2. List the signs and symptoms of (C) APD and, correlate them with different central auditory processes
3. List different tests of (C) APD 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 (C) APD
6. Explain management strategies and techniques for improving different central auditory processes

Unit 1: Introduction to (Central) Auditory Processing Disorder [(C) APD] & Screening

- Definition
- Processes involved such as
 - Binaural integration
 - Binaural separation
 - Temporal processing
 - Auditory closure
 - Binaural interaction
 - Phoneme synthesis
 - Auditory memory and sequencing
 - Sound localization and lateralization
- Neural maturation and auditory processing
- Neural degeneration and auditory processing
- Signs and symptoms of (C) APD
- Classification of auditory processing disorder
- (C) APD as a co-morbid disorder
- Screening for (C)APD
 - Questionnaires based
 - Sub-tests of speech / language tests
 - Audiological tests

Unit 2: Diagnostic Assessment of APD

- Physiological assessment in assessment of APD such as
 - ABR
 - AMLR
 - ALLR

- MMN
- P300
- Contralateral suppression of OAEs
- Behavioural tests in assessment of (C) APD
 - Tests for assessing temporal processing
 - Tests for assessing Binaural interaction
 - Tests for assessing Binaural integration/separation
 - Monaural low redundancy tests
 - Tests for assessing auditory memory and sequencing
- Assessment of (C) APD in subjects with peripheral hearing loss
- Factors affecting assessment of (C) APD
 - Factors related to subject
 - Factors related to procedure
- Construction and standardisation of tests for assessment of (C) APD

Unit 3: Overview to management of (C) APD

- Environmental modifications
- Devices for subjects with auditory processing disorder
- Compensatory strategies
- Role of auditory plasticity in management of (C) APD
- Direct remediation techniques
 - Bottom-up approaches
 - Top-down approaches
- Phoneme synthesis training
- Metacognitive and metalinguistic approaches

Unit 4: Management of (C) APD – Process specific techniques

- Auditory perceptual training for problems in
 - Binaural integration
 - Binaural separation
 - Temporal processing
 - Auditory closure
 - Binaural interaction
 - Phoneme synthesis
 - Auditory memory and sequencing
 - Sound localization and lateralization
- Factors affecting management of (C) APDs
- Team approach for assessment and management of (C) APD

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Paper Code: AUD 4.2 - HC: Audiology in Practice

Objectives:

After studying this subject:

1. Student should know the role of an Audiologist in different set-ups should be capable of helping the concerned professional in setting up an audiological clinic and also be capable of auditing the practices in an already existing set-up.
2. Student should know the national and international legislations relating people with hearing disability.
3. Student should know the role played by an Audiologist in legal matters.
4. Student should be aware of the welfare measures for the people with hearing disability.

Unit 1

a) Scope of an audiologist in

- Rural/tribal areas
- Paediatric setup
- Neurological setup
- Otolaryngological setup
- Industrial setup
- School setup
- Private practice

Including auditing in all these set-ups.

b) Infrastructure (equipment, space, room design, financing) requirements for

- Rural/tribal areas
- Paediatric setup
- Neurological setup
- Otolaryngological setup
- Industrial setup
- School set up
- Private practice

c) Auditing progress in different setups

- Method to audit
- Goals to be achieved
- Measures to be taken to prevent malpractice by allied professionals

Unit 2

- a) 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
- Including auditing in all these set-ups.
- b) Scope of different government departments/ non-government organizations in prevention, identification and rehabilitation of individuals with hearing impairment such as:
- Health, family welfare,
 - Women & child development,
 - Social justice & empowerment,
 - Education department,
 - Human resource department
 - Others government departments
 - Non-government organization

Unit 3

- a) Designing acoustically treated rooms:
- Transmission loss
 - Reverberation control
 - Illumination
 - Electrical connections
 - Electrical shielding, grounding
 - Connecting jacks
 - Professionals involved in designing/construction audiological test facility
- b) Telepractice in Audiology
- Concept of telepractice
 - Need for telepractice
 - Method and infrastructure requirement
 - Advantages and limitations of telepractice

Unit 4

- a) Medico-legal aspects in Audiology
- Forensic Audiology
 - Audiologist as an expert witness
 - Ethics in practice (in India and in other countries)
 - Report writing
- b) Law and Audiology
- Legislations – National Acts - PWD Act, RCI Act, FDA, UNCRPD, NPPCD, Sarvasiksha Abhiyan

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- Biwako Millenium Framework, Salamanca statement and framework
 - Insurance against malpractice, consumer protection act, evidence act
 - Measures to implement legislations
- c) Welfare measures for the hearing impaired in India regarding:
- Travel
 - Education
 - Vocation
 - Others
 - Comparison with other disabilities
- d) 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)

Reference:

Unit 1

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Unit 2

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Unit 3

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Unit 4

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5. 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: a) Perception of vowels, semivowels, and diphthongs in individuals with hearing impairment

b) Perception of consonants in individuals with a hearing impairment

c) Effect of type, degree and audiogram configuration in perception of vowels and consonants

Unit 2: a) 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 o

b) Perception of suprasegmental cues in individuals with hearing impairment:

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

c) Perception of speech through the visual modality

- Perception of segmental and suprasegmental cues

d) Perception of speech through the tactile modality

- Perception of segmental and suprasegmental cues

Unit 3: a) Perception of speech through cochlea implants

- Overview of speech perception through single channel implants:
 - Vowels perception
 - Consonants perception
 - Speech identification scores
 - Suprasegmental cues
- Perception through multi-channel cochlear implants
 - Vowels perception
 - Consonants perception
 - Speech identification scores
 - Suprasegmental cues
- Effect of coding strategy on speech perception
- Effect of implant model on speech perception
- Speech perception through auditory brain-stem implants
- Comparison of speech perception through different devices/modalities:
 - Hearing aids vs. cochlear implants
 - Hearing aids vs. tactile devices
 - Cochlear implants vs. tactile devices
 - Tactile vs. visual perception

b) 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: a) Speech intelligibility

- Methods:
 - 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
- Application of speech intelligibility
 - In the area of evaluation
 - In the area of rehabilitation
 - In the area of research

b) Speech perception in adverse listening conditions

- Effect of noise on speech perception in normal and the hearing impaired
 - Effect of different types of noise

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- 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

c) Application of speech perception in:

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

Reference:

Unit 1

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Unit 2

1. Carney, A. E., Kienle, M., Miyamoto, R. T. (1990). Speech perception with a single-channel cochlear implant: a comparison with a single-channel tactile device. *Journal of Speech and Hearing Research*, 33(2):229-37.
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Unit 3

1. Bosco et al. (2004). Comparison between the speech perception skills in children with cochlear implants using different strategies such as CIS, SAS and Hi-Resolution. *Acta Otolaryngologica*, 125, 148-158.
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Unit 4

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Paper Code: AUD 4.4 - HCC: Clinical Practicum I

Paper Code: AUD 4.5 - HC: Dissertation