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UNIVERSITY OF MYSORE

Estd. 1916

Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005

No.AC.2(S)/384/14-15

Dated: 28.05.2016
01-6

NOTIFICATION

Sub: Modification to the Regulations, Structure and Syllabus of M.Sc. (Audiology) Programme from the Academic Year 2016-17.

Ref: 1. Decision of the Faculty of Science & Technology Meeting held on 16.02.2016.
2. Decisior of the Academic Council meeting held on 29-03-2016.

*****

The Board of Studies in Speech- Language Pathology (PG) which met on 24-11-2015 has resolved to modify the Regulations, Structure and Syllabus of M.Sc. (Speech Language Pathology) Programme from the academic year 2016-17.

The Faculty of Science and Technology and the Academic Council at their Meetings held on 16.02.2016 and 29.03.2016 respectively have also approved the above said proposal and the same is hereby notified.

The Modified Regulations, Structure and Syllabus of M.Sc. (Audiology) Programme is annexed and it may be downloaded from the University website i.e., www.uni-mysore.ac.in

Draft approved by the Registrar

Deputy Registrar (Academic)

31/5/16

To:

1) The Dean, Faculty of Science & Technology, DOS in Earth Science, MGM.
2) The Registrar (Evaluation), University of Mysore, Mysore.
3) The Director, All India Institute of Speech and Hearing, Manasagangotri, Mysore.
4) The Chairperson, BOS in Speech-Language Pathology (PG), All India Institute of Speech and Hearing, Manasagangotri, Mysore.
5) The Principal, JSS Institute of Speech and Hearing, M.G.Road, Mysore.
6) The Deputy/Assistant Registrar/Superintendent, Academic Section, Administration Branch, University of Mysore, Mysore.
7) The Deputy/Assistant Registrar/Superintendent, Examination Branch, UOM, Mysore.
8) The P.A. to the Vice-Chancellor/Registrar/Registrar(Evaluation), UOM., Mysore.
9) Office file.

Science Notification-2016-17 Ja

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NOTIFICATION

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Ref: 1. Decision of the Faculty of Science & Technology Meeting held on 16.02.2016.
2. Decision of the Academic Council meeting held on 29-03-2016.

*****

The Board of Studies in Audiology (PG) which met on 24-11-2015 has resolved to Modify the Regulations, Structure and Syllabus of M.Sc. (Speech Language Pathology) Programme from the academic year 2016-17.

The Faculty of Science and Technology and the Academic Council at their Meetings held on 16.02.2016 and 29.03.2016 respectively have also approved the above said proposal and the same is hereby notified.

The Modified Regulations, Structure and Syllabus of M.Sc. (Audiology) Programme is annexed and it may be downloaded from the University Website i.e., www.uni-mysore.ac.in

Draft approved by the Registrar

Deputy Registrar (Academic)

To:

1) The Dean, Faculty of Science & Technology, DOS in Earth Science, MGM.
2) The Registrar (Evaluation), University of Mysore, Mysore.
3) The Director, All India Institute of Speech and Hearing, Manasagangotri, Mysore, with a request to send the proposed/revised changes along with existing/amended Regulations, in the juxtaposition manner, through the Director to this office to take needful action in this regard.
4) The Director, College Development Council, University of Mysore, Mysore.
5) The Principal, JSS Institute of Speech and Hearing, M.G.Road, Mysore.
6) The Deputy/Assistant Registrar/Superintendent, Academic Section, Administration Branch, University of Mysore, Mysore.
7) The Deputy/Assistant Registrar/Superintendent, Examination Branch, UOM, Mysore.
8) The P.A. to the Vice-Chancellor/Registrar/Registrar(Evaluation), UOM., Mysore.
9) Office file.

UNIVERSITY OF MYSORE

REGULATIONS AND SYLLABUS - M.Sc. (Audiology) 2016

	Existing		Proposed
1.0	**Title and Commencement**	**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 ***2013-14.***	1.1	These Regulations shall be called the University of Mysore regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for **M.Sc. (Audiology) Programme.** These Regulations shall come into force from the academic year **2016-17**.
2.0	**Duration of the program**	**2.0**	**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.	2.1	Duration of the program: **4 semesters** **Note:** Each semester shall extend over a minimum period of **eighteen weeks, excluding examination days.**
3.0	**Definitions**	**3.0**	**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	**3.1**	**Course** Every course offered will have three components associated with the teaching-learning process of the course, namely (i) Lecture – L (ii) Tutorial- T (iii) Practicum (Clinical) - P, where **L** stands for Lecture session. **T** stands for Tutorial session consisting participatory discussion / self study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes. **P** stands for Practicum (Clinical)

	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:		which would involve hands-on experience involving persons with communication disorders in clinical and other setups such as hospitals/clinics/ outreach centres. A course shall have either or all the above components. The total credits earned by a student at the end of the semester upon successfully completing the course **are** L + T + P. The credit pattern of the course is indicated as L: T : P. Different courses of study are labelled and defined as follows:
3.2	**Core Course** A course which should compulsorily be studied by a ***candidate*** as a core-requirement is termed as a Core course.	**3.2**	**Core Course** A course which should compulsorily be studied by a **student** as a core-requirement is termed as a Core course.
3.2.1	A Core course may be a **Soft Core** if there is a choice or an option for the ***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**.**	3.2.1	A Core course may be a **Soft Core** if there is a choice or an option for the **student** to choose a course from a pool of courses from the main discipline / subject of study or from a sister/related discipline / subject which supports the main discipline / subject. In contrast to the phrase Soft Core, a compulsory core course is called a **Hard Core** Course**.**
3.3	**Elective Course** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline / subject of study or which provides an extended scope or which enables an exposure to some other discipline / subject/domain or nurtures the	**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 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.		**student**'s proficiency/ skill is called an Elective Course. Elective courses may be offered by the main discipline / subject of study or by sister / related discipline / subject of study. A Soft Core course may also be considered as an elective. An elective course chosen generally from an unrelated discipline / subject, with an intention to seek exposure is called an **open elective**. An elective course designed to acquire a special/advanced knowledge, such as Supplement study/support study to a project work, and a **student** studies such a course on his own with an advisory support by a teacher is called a **Self Study Elective**. A core course offered in a discipline / subject may be treated as an elective by other discipline / subject and vice versa.
3.4	**Dissertation** is another special course of 7 credits involving ***a problem solving component***.	**3.4**	**Dissertation** is a soft core of 6 credits involving **research on a specific topic and scientific report writing**
4.0	**Eligibility for admission.**	**4.0**	**Eligibility for admission.**
4.1	***Candidate***s with a BASLP / B.Sc. (Speech & Hearing) degree fulfilling all the following criteria are eligible for admission:	4.1	**Students** with a B.ASLP / B.Sc. (Speech & Hearing) degree fulfilling all the following criteria are eligible for admission:
4.1.1	Degree from the University of Mysore or any other University considered as equivalent.	4.1.1	Degree from the University of Mysore or any other University/ Institute considered as equivalent.
4.1.2	***The program should be approved by RCI and***	4.1.2	The program should be **approved by Rehabilitation Council of India (RCI), excluding Institutes of**

			National Importance and Foreign programs.
4.1.3	An average of not less than 50% of marks 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].	4.1.3	An average of not less than 50% of marks or **Equivalent CGPA** in the qualifying examination. [**Note:** 'Average' refers to the average of the aggregate marks/**CGPA** of all the years/semesters of **B.ASLP**/ B.Sc. (Speech & Hearing)/equivalent programme].
4.2	Admission shall be made only on the basis of the marks obtained in the entrance examination conducted by the training institutes for this purpose as per their stipulated rules and regulations. (eligibility differs for categories) Further, only those ***candidate***s who secure ***more than 40%*** in the entrance examination are eligible for admission.	4.2	Admission shall be made only on the basis of the marks obtained in the entrance examination conducted by the training institutes for this purpose as per their stipulated rules and regulations. (eligibility differs for categories) Further, only those **students who qualify in the** entrance examination are eligible for admission.
4.3	Entrance Examination	4.3	Entrance Examination
4.3.1	The objective of entrance examination is to assess the knowledge and skill of the ***candidate***s in the subjects of B.Sc. (Speech & Hearing)/***BASLP***.	4.3.1	The objective of entrance examination is to assess the knowledge and skill of the **student**s in the subjects of B.Sc. (Speech & Hearing)/**B.ASLP or equivalent**.
4.3.2	The entrance examination shall be conducted as notified from time-to-time as per the rules and regulations of the training institute.	4.3.2	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.	4.3.3	The selection committee shall consist of the Head of the Institution, as Chairperson, one faculty member of the institution nominated by Head of the Institution, and one member nominated by the Vice-Chancellor of

			the **University of Mysore**.
5.0	**Scheme of Instruction**	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.**	5.1	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.	5.2	The syllabus of every paper is divided into four units.
5.3	***Candidate***s shall attend camps/extension programs/***educational tour*** conducted by the institution.	5.3	**Student**s shall attend camps/extension programs 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 semesters, he /she has to study the prevailing courses offered by the department when he / she continues his / her studies.	5.4	A Master's Degree program is of 4 semesters duration. A **student** can avail a maximum of 8 semesters – 4 years (in one stretch) to complete the Master's Degree (including blank semesters, if any). Whenever a **student** opts for blank semesters, he /she has to study the prevailing courses offered by the department when he / she continues his / her studies.
5.5	A ***candidate*** has to earn a minimum of 77 credits for successful completion of the master's degree. The 77 credits shall be earned by the ***candidate*** by studying ***Hardcore, Soft core /electives / dissertation / Clinical Practicum,*** as specified in the program. The degree shall be awarded at the end ***of the two years***.	5.5	A **student** has to earn a minimum of 77 credits for successful completion of the master's degree. The 77 credits shall be earned by the **student** by studying **Hard Core, Soft Core, Electives, and Clinical Practicum,** as specified in the program. The degree shall be awarded on **successful completion of the program.**
5.6	Only such ***candidate***s who register for a minimum of 18 credits per semester in the first two semesters and complete successfully 77 credits in 4 successive semesters shall be	5.6	Only such **student**s who register for a minimum of 18 credits per semester in the first two semesters and complete successfully 76 credits in 4 successive semesters shall be

	considered for declaration of ranks, medals and are eligible to apply for student fellowship, scholarship, free ships and hostel facilities.		considered for declaration of ranks, medals and are eligible to apply for student fellowship, scholarship, free ships and hostel facilities.
6.0	**Attendance**	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.	6.1	Each course shall be taken, as a unit for purpose of calculating attendance and a **student** shall be considered to have put in the required attendance for the course, if he/she has attended not less than 80% in case of theory classes and 90% in case of clinical practicum.
6.2	A ***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 ***candidate***s are permitted to avail this facility (6.2) in the I & III semesters only, with prior permission of the Head of the Institution.	6.2	A **student** who is having shortage of attendance in clinical practicum is permitted to make up this shortage by attending clinical work during vacation/s immediately after that semester and he /she has to study the prevailing courses offered by the department when he / she continues his / her studies. **Note:** The **student**s are permitted to avail this facility (6.2) in the I & III semesters only, with prior permission of the Head of the Institution.
6.3	A ***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.	6.3	A **student**, who fails to satisfy the requirement of attendance in a course, shall reregister for the same in case of HC, register for the same or alternative course in case of SC/OE when it is offered next. However not exceeding double the duration of the programme. **Note:** This facility shall be available only **once** in the entire programme.
6.4	If a ***candidate*** represents his/her	**6.4**	If a **student** represents his/her

Comment [s1]: To give also in procedure

	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.		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.	**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:	**8.0**	**Continuous assessments *earning of credits* and award of grades** The evaluation of the **student** 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 C_1, C_2, and C_3.	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 C_1, C_2, and C_3.
8.2	The performance of a ***candidate*** in a course will be assessed for a maximum of 100 marks as explained below.	8.2	The performance of a **student** in a course will be assessed for a maximum of 100 marks as explained below.
8.2.1	The first component (C_1), 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 t***otal*** units in a course) will be completed. This shall be consolidated during the 8^{th} week of the semester.	8.2.1	The first component (C_1), of assessment is for 25 marks. This will be based on test, assignment, seminar. During the **first eight weeks of the semester,** the first 50% of the syllabus (**two units in a course)** will be completed. This shall be consolidated during the 8^{th} week of the semester.
8.2.2	The second component (C_2), of assessment is for 25 marks. This will	8.2.2	The second component (C_2), 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.		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 (C_1) and Component-II (C_2) 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 (C_1) and component II (C_2) of assessment are immediately returned to the ***candidate***s after obtaining acknowledgement in the register maintained by the concern teacher for this purpose.	8.2.2.1	The outline for continuous assessment activities for Component-I (C_1) and Component-II (C_2) 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 **student**s should be informed about the modalities well in advance. The evaluated courses/assignments during component I (C_1) and component II (C_2) of assessment are immediately returned to the **student**s after obtaining acknowledgement in the register maintained by the concerned teacher for this purpose.
8.2.3	During the 18th -20th week of the semester, a semester-end examination of 2 hours duration shall be conducted for each course. This forms the third/final component of assessment (C_3) and the maximum marks for the final component will be 50. **Note: Model question paper pattern is as given in Annexure – II**	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 (C_3) 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**	**Clinical Practicum**
8.3.1	The clinical practicum examinations shall be in the main subjects of	8.3.1	**The clinical practicum shall be in the main courses of study, i.e., in**

<table>
<tr><td></td><td>study, i.e., in Audiology/Speech-Language Pathology which would be conducted by internal examiners.</td><td></td><td>Audiology.</td></tr>
<tr><td>8.3.2</td><td>Clinical practicum is part of all the semesters. The internal assessment will be conducted continuously, through the semesters.</td><td>8.3.2</td><td></td></tr>
<tr><td>8.3.3</td><td>Break-up of marks of clinical practicum shall be as follows:
Odd Semesters:
Components — Basis of assessment
C_1+ C_2 : 50 marks — • Clinical skill/repertoi</td><td></td><td></td></tr>
</table>

	(internal assessment)	***re*** • ***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 (clinical viva)*	***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+ C_2: 50 marks ***(internal assessment)***	• **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 clinical*** **work** • **Professional attitude/ motivation/aptitude for clinical work**
C_3: 50 marks ***(clinical viva)***	**Clinical viva-voce is conducted to examine the *candidate*'s clinical skills (prior to the commencement of the theory examination). Clinical viva-voce examination will be conducted by two internal**

	faculty. However, the BoE on its discretion can also invite external examiners, if required.		
8.4	**Dissertation work**	**8.4**	**Dissertation work -** Soft core
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***.	8.4.1	There shall be 100 marks for dissertation work. **Dissertation would be conducted by each candidate over a period of 2 semesters (III and IV semesters). Dissertation I of the semester III and Dissertation II of the semester IV shall be in the same course. The results of Dissertation would be announced only at the end of the IV semester consolidating the continuous assessment of the both Dissertation I and II.**

<table>
<tr>
<td>8.4.2</td>
<td>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

<table>
<tr><th>Components</th><th>Basis</th><th>Remarks</th></tr>
<tr><td>C_1: 25%</td><td>Preparation of research proposal</td><td>To be awarded by the Guide</td></tr>
<tr><td>C_2 : 25%</td><td>Research proposal</td><td>To be evaluated by a panel of two members consisting of the guide and an internal examiner</td></tr>
<tr><td>C_3: 50%</td><td>Periodic progress and progress report following Research proposal.</td><td>To be awarded by the Guide</td></tr>
</table>
</td>
<td>8.4.2</td>
<td>Right from the initial stage of defining the problem, the student has to submit progress reports periodically and also present the progress and hold regular discussions with the guide. Components of evaluation are as follows:

In the III Semester, C_1will be based on Preparation of research proposal and will be assessed by the guide. C_2 will be based on Presentation of research proposal and will be evaluated by a panel of two members consisting of the guide and an internal examiner. C_3 will be based on Periodic progress and progress report following research proposal, to be awarded by the Guide</td>
</tr>
</table>

<table>
<tr><td></td><td>IV Semester
<table>
<tr><th>Components</th><th>Basis</th><th>Remarks</th></tr>
<tr><td>C_1: 25%</td><td>Periodic progress and progress report</td><td>To be awarded by the Guide</td></tr>
<tr><td>C_2: 25%</td><td>Results of Work and Draft Report</td><td>To be awarded by the Guide</td></tr>
<tr><td>C_3: 50%
Report evaluation: 30% and
Viva-voce examination: 20%</td><td>Final viva-voce and evaluation</td><td>To be evaluated by a panel of two members consisting of the guide and an Internal examiner</td></tr>
</table></td><td></td><td>In the IV Semester, C_1 will be based on periodic progress and progress report. C_2 will be based on results of the study and draft report. Both C_1 and C_2 will be awarded by the guide. C_3 will be based on final viva-voce and evaluation of the report. This will be awarded by a panel of two members consisting of the guide and an internal examiner. Report evaluation will carry a weightage of 60% while viva-voce examination will be of 40% weightage.</td></tr>
<tr><td>8.4.3</td><td>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.</td><td>8.4.3</td><td>The students shall submit three copies of dissertation before the commencement of theory examination of that semester. Students who fail to submit their dissertations on or before the stipulated date shall not be permitted to appear for the final dissertation viva voce.</td></tr>
<tr><td>8.4.4</td><td>A candidate who is said to have DROPPED dissertation work has to re-register for the same subsequently within the stipulated period.</td><td>8.4.4</td><td>A student who is said to have DROPPED dissertation work has to re-register for the same subsequently within the stipulated period.</td></tr>
<tr><td>8.3.4</td><td>In case a candidate secures less than</td><td>8.5</td><td>In case a student secures less than</td></tr>
</table>

	30% in $C_1$and C_2 put together in a course, the ***candidate*** is said to have DROPPED that course, and such a ***candidate*** is not allowed to appear for C_3 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 C_3 in that course. Teachers offering the courses will place the above details in the Department Council meeting during the last week of the semester, before the commencement of C_3, and subsequently a notification pertaining to the above will be brought out by the Chairman of the Department before the commencement of C_3 examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation). In case a ***candidate*** secures less than **30%** in C_3, he/she may choose DROP/MAKEUP option. In case a ***candidate*** secures more than or equal to 30% in C_3, 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		**40%** in C_1 and C_2 put together in a course, the **student** is said to have DROPPED that course, and such a **student** is not allowed to appear for C_3 in that course. In case a **student**'s attendance in a course is less than the stipulated percentage, the **student** is said to have DROPPED that course, and such a **student** is not allowed to appear for C_3 in that course. Teachers offering the courses will place the above details in the Department Council meeting during the last week of the semester, before the commencement of C_3, and subsequently a notification pertaining to the above will be brought out by the Chairman of the Department before the commencement of C_3 examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation). In case a **student** secures less than **40% in C_3,** he/she may choose DROP/MAKEUP option. In case a **student** secures more than or equal to **40%** in C_3, but his/her grade **(G) = 5**, as per section **8.9** below, then he/she may be declared to have been conditionally successful in this course, provided that such a benefit of conditional clearance based on G = 5 shall not be availed for a maximum of 8 credits for the entire programme of Master's Degree.

	Degree of two years. In case a ***candidate*** secures more than **30 %** in C_3 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.		In case a **student** secures more than **40%** in C_3 but G=5, then he/she may choose DROP/MAKE-UP option. The **student** has to exercise his/her option immediately within 10 days from the date of notification of results. **A MAKE-UP examination for odd semester courses will be conducted along with next regular odd semester examinations and for even semester courses along with the next regular even semester examinations. If a student is still unsuccessful, he/she may opt to DROP or again take up a MAKE-UP examination. However, not exceeding double the duration norm in one stretch from the date of joining the course.** A **student** has to re-register for the DROPPED course when the course is offered again by the department, if it is a hard core course. The **student** may choose the same or an alternate core/elective in case the dropped course is soft core / elective course. A **student** who is said to have DROPPED **the course** has to re-register for the same subsequently within the stipulated period. The details of any dropped course will not appear in the grade card. **However, if a candidate secures less than 50% in C_3 of the clinical courses, no make-up examination would be given and candidate shall be considered to have dropped the course and re-register for the course.**

8.5	**Setting questions papers and evaluation of answer scripts.**	8.6	**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.	**8.6.1** I	Questions papers in three sets shall be set by internal / external examiners for a course.
II	The Board of Examiners shall scrutinize and approve the question papers and scheme of valuation.	II	The Board of Examiners shall scrutinize and approve the question papers and scheme of valuation.
III	There shall be single valuation for all theory papers by internal examiners. In case, the number of internal examiners falls short, external examiners may be invited. The marks awarded by the internal examiners shall be taken as the final marks for that particular course. The examination for ***practical*** work/***field work/project*** work will be conducted jointly by two internal examiners. However, the BoE on its discretion can also invite external examiners, if required.	III	There shall be single valuation for all theory papers by internal examiners. In case, the number of internal examiners falls short, external examiners may be invited. The marks awarded by the internal examiners shall be taken as the final marks for that particular course. The examination for **clinical** work/**dissertation** work will be conducted jointly by two internal examiners. However, the BoE on its discretion can also invite external examiners, if required.
IV	Challenge valuation: A student who desires to apply for challenge valuation shall obtain a photocopy of the answer script by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Registrar (Evaluation) within 15 days after the announcement of the results. This challenge valuation is only for C_3 component. The answer scripts for which challenge valuation is sought for	IV	Challenge valuation: A student who desires to apply for challenge valuation shall obtain a photocopy of the answer script by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Registrar (Evaluation) within 15 days after the announcement of the results. This challenge valuation is only for C_3 component. The answer scripts for which challenge valuation is sought for shall be sent to another examiner. The

<table>
<tr><td></td><td>shall be sent to another examiner. The marks awarded will be the higher of the marks obtained in the challenge valuation and in maiden valuation.</td><td></td><td>marks awarded will be the higher of the marks obtained in the challenge valuation and in maiden valuation.</td></tr>
<tr><td>8.5.2</td><td>In case of a course with only practical component a practical examination will be conducted with two internal 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. The duration for semester-end practical examination shall be decided by the departmental council.</td><td>8.6.2</td><td>In case of a course with only practical component a practical examination will be conducted with two internal examiners. A student will be assessed on the basis of a) Knowledge of relevant processes b) Skills and operations involved c) Results / products including calculation and reporting. The duration for semester-end practical examination shall be decided by the departmental council.</td></tr>
<tr><td>8.5.3</td><td>If a course has both theory and practical components with credit pattern L : T : P, then as parts of (C_1 and C_2) both theory and practical examinations shall be conducted for 50 marks each. The final (C_3) 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 C_3 in theory examination, if Y is the marks scored by the candidate out of 50 in C_3 in Practical examination, and if Z is the marks scored by the candidate out of 50 in C_3 for a course of (L=0):T:(P=0)type that is entirely tutorial based course, then the final marks M in C_3 is decided as per the following table.

<table><tr><th>L.T.P distribution</th><th>Find mark M in C_3</th></tr><tr><td>L:T:P</td><td>[(L+T)*X]+[(T+P)</td></tr></table></td><td>8.6.3</td><td>If a course has both theory and practical components with credit pattern L : T : P, then as parts of C_1 and C_2, both theory and practical examinations shall be conducted for 50 marks each. The final (C_3) component marks shall be decided based on the marks secured by the student in the theory examinations. If X is the marks scored by the student out of 50 in C_3 in theory examination, if Y is the marks scored by the student out of 50 in C_3 in practical examination, and if Z is the marks scored by the student out of 50 in C_3 for a course of (L=0):T:(P=0)type that is entirely tutorial based course, then the final marks M in C_3 is decided as per the following table.

<table><tr><th>L.T.P distribution</th><th>Final mark M in C_3</th></tr><tr><td>L:T:P</td><td>[(L+T)*X]+[(T+</td></tr></table></td></tr>
</table>

		*Y] L+2T+P			P)*Y] L+2T+P
	L:(T=0):P	(L*X)+(P*Y) L+P		L:(T=0):P	(L*X)+(P*Y) L+P
	L:T:(P=0)	X		L:T:(P=0)	X
	L:(T=0):(P=0)	X		L:(T=0):(P=0)	X
	(L=0):T :P	Y		(L=0):T :P	Y
	(L=0): (T=0):P	Y		(L=0): (T=0):P	Y
	(L=0): T:(P=0)	Z		(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 8th week
C_2	Remaining 50% (Remaining units of the course)	25 %	Second half of the semester. To be consolidated by 16th week
C_3	Semester-end examination (All units of the course)	50 %	To be completed during 18th-20th Week.

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

Component	***Syllabus in a course***	***Weightage***	***Period of Continuous assessment***
C_1	First 50% (2 units ***of total units***)	25 %	First half of the semester. To be consolidated by 8th week
C_2	Remaining 50% (Remaining units of the course)	25 %	Second half of the semester. To be consolidated by 16th week
C_3	Semester-end examination (All units of	50 %	To be completed during 18th-20th Week.

	Final grades to be announced latest by 24th week		the course) ***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).	8.6.5	A **student's** performance from all 3 components will be in terms of scores, and the sum of all three scores will be for a maximum of 100 marks (25 + 25 + 50).
8.5.6	**Finally, awarding the grades should be completed latest by 24th week of the semester**.	**8.6.6**	**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 $C_1$and C_2 put together in a course, the candidate is said to have DROPPED that course, and such a candidate is not allowed to appear for C_3 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 C_3 in that course.*** ***Teachers offering the courses will place the above details in the Department Council meeting during the last week of the semester, before the commencement of C_3, and subsequently a notification pertaining to the above will be brought out by the Chairman of the Department before the commencement of C_3 examination. A copy of this notification shall also***		***(Given earlier)***

	be sent to the office of the Registrar & Registrar (Evaluation).		
8.7	***In case a candidate secures less than 30% in C_3, he/she may choose DROP/MAKEUP option. In case a candidate secures more than or equal to 30% in C_3, 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 C_3 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.***		
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***	8.8	

<table>
<tr><td></td><td>within the stipulated period. The details of any dropped course will not appear in the grade card.</td><td></td><td></td></tr>
<tr><td>8.9</td><td>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.</td><td>8.7</td><td>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.</td></tr>
<tr><td>8.10</td><td>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).</td><td>8.8</td><td>Upon successful completion of Masters degree, a final grade card consisting of grades of all courses successfully completed by the student will be issued by the Registrar (Evaluation).</td></tr>
<tr><td>8.11</td><td>The grade and the grade point earned by the candidate in the course will be as given below.

<table>
<tr><th>P</th><th>G</th><th>GP = V x G</th></tr>
<tr><td>30-39</td><td>4</td><td>V*4</td></tr>
<tr><td>40-49</td><td>5</td><td>V*5</td></tr>
<tr><td>50-59</td><td>6</td><td>V*6</td></tr>
<tr><td>60-64</td><td>6.5</td><td>V*6.5</td></tr>
<tr><td>65-69</td><td>7</td><td>V*7</td></tr>
<tr><td>70-74</td><td>7.5</td><td>V*7.5</td></tr>
<tr><td>75-79</td><td>8</td><td>V*8</td></tr>
<tr><td>80-84</td><td>8.5</td><td>V*8.5</td></tr>
<tr><td>85-89</td><td>9</td><td>V*9</td></tr>
<tr><td>90-94</td><td>9.5</td><td>V*9.5</td></tr>
<tr><td>95-100</td><td>10</td><td>V*10</td></tr>
</table>
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.</td><td>8.9</td><td>The grade and the grade point earned by the student in the course will be as given below.

<table>
<tr><th>P</th><th>G</th><th>GP = V x G</th></tr>
<tr><td>40-49</td><td>5</td><td>V*5</td></tr>
<tr><td>50-59</td><td>6</td><td>V*6</td></tr>
<tr><td>60-64</td><td>6.5</td><td>V*6.5</td></tr>
<tr><td>65-69</td><td>7</td><td>V*7</td></tr>
<tr><td>70-74</td><td>7.5</td><td>V*7.5</td></tr>
<tr><td>75-79</td><td>8</td><td>V*8</td></tr>
<tr><td>80-84</td><td>8.5</td><td>V*8.5</td></tr>
<tr><td>85-89</td><td>9</td><td>V*9</td></tr>
<tr><td>90-94</td><td>9.5</td><td>V*9.5</td></tr>
<tr><td>95-100</td><td>10</td><td>V*10</td></tr>
</table>
Here, P is the percentage of marks (P=[(C_1+C_2)+M]) secured by a student in a course which is rounded to nearest integer. V is the credit value of course. G is the grade and GP is the grade point.</td></tr>
<tr><td>8.12</td><td>A candidate also has an option to withdraw a course even after final</td><td>8.10</td><td>A student also has an option to withdraw a course even after final</td></tr>
</table>

<table>
<tr><td></td><td>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 C_3 components, in which the ***candidate*** has to reappear for only C_3 component to improve, carrying the marks of C_1 and C_2 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.</td><td></td><td>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 C_3 components, in which the student has to reappear for only C_3 component to improve, carrying the marks of C_1 and C_2 components (this option is called PENDING option), or for the entire course where the student has to reenrol for the course afresh or can chose an alternative course if the withdrawal course is a soft/elective core (this option is called DROPPED option). This act of withdrawing should be immediately within seven days after the announcement of final results.</td></tr>
<tr><td>8.13</td><td>Overall cumulative grade point average (CGPA) of a ***candidate*** after successful completion the required number of credits ***(76)*** is given by

CGPA = Σ GP / Total number of credits (calculated up to 4 decimal places)</td><td>8.11</td><td>Overall cumulative grade point average (CGPA) of a student after successful completion of the program for the required number of credits (77) is given by
CGPA = Σ GP / Total number of credits (calculated up to 4 decimal places)</td></tr>
<tr><td>9.0</td><td>Classification of results:</td><td>9.0</td><td>Classification of results:</td></tr>
<tr><td></td><td>The final grade point (FGP) to be awarded to the student is based on CGPA secured by the ***candidate*** and is given as follows.

<table>
<tr><th>CGPA</th><th colspan="2">FGP</th></tr>
<tr><th></th><th>Numerical Index</th><th>Qualitative Index</th></tr>
<tr><td>4 <= CGPA < 5</td><td>5</td><td>SECOND CLASS</td></tr>
</table></td><td></td><td>The final grade point (FGP) to be awarded to the student is based on CGPA secured by the student and is given as follows.

<table>
<tr><th>CGPA</th><th colspan="2">FGP</th></tr>
<tr><th></th><th>Numerical Index</th><th>Qualitative Index</th></tr>
<tr><td>4 <= CGPA < 5</td><td>5</td><td>SECOND CLASS</td></tr>
</table></td></tr>
</table>

	5 <= CGPA < 6	6			5 <= CGPA < 6	6	
	6 <= CGPA < 7	7	FIRST CLASS		6 <= CGPA < 7	7	FIRST CLASS
	7 <= CGPA < 8	8			7 <= CGPA < 8	8	
	8 <= CGPA < 9	9	DISTINCTION		8 <= CGPA < 9	9	DISTINCTION
	9 <= CGPA < =10	10			9 <= CGPA < =10	10	
	Overall percentage = 10*CGPA ***or is said to be 50% in case of CGPA < 5***				Overall percentage = 10*CGPA		
10.0	**Provisions for Repeaters**			10.0	**Provisions for Repeaters**		
10.1	A ***candidate*** is allowed to carry all the previous uncleared ***papers*** **except clinical practicum** to the subsequent semester/semesters subject to Regulation 8.3.3.			10.1	A **student** is allowed to carry all the previous uncleared **courses except clinical practicum** to the subsequent semester/semesters subject to Regulation 8.5		
11.0	**Provision for appeal**			**11.0**	**Provision for appeal**		
11.1	If a ***candidate***, is not satisfied with the evaluation of C_1 and C_2 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			11.1	If a **student** is not satisfied with the evaluation of C_1 and C_2 components, he / she can approach the grievance cell with the written submission together with all the facts, 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		

	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.		**student** if his/her submission is found to be baseless and unduly motivated. This cell may recommend taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cell is final.
11.2	For every program there will be one grievance cell. The composition of the grievance cell is as follows. 1. The Registrar (Evaluation) ex-officio Chairman / Convener 2. One senior faculty member (other than those concerned with the evaluation of the course concerned) drawn from the department/discipline and/or from the sister departments/sister disciplines. One senior faculty members / subject experts drawn from outside the University department.	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. One senior faculty member / subject experts drawn from outside the University department.
12.0	**Barring of simultaneous study**	**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.	12.1	No **student** admitted to the degree programme in a College/Institution under the jurisdiction of this University shall be permitted to study simultaneously in any other programme leading to a degree (regular, evening & morning) offered by this or any other University.
12.2	If a ***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.	12.2	If a **student** gets admitted to more than one programme, the University shall cancel without giving prior notice, his/her admission to all the programmes to which he/she has joined.
13.0	**Miscellaneous**		**Miscellaneous**

13.1	These revised regulations will apply to ***candidate***s admitted for the academic year ***2013-14*** and onwards.	13.1	These revised regulations will apply to **student**s admitted for the academic year **2016-17** and onwards.
13.2	Any other issue, not envisaged above, shall be resolved by the Vice Chancellor in consultation with the appropriate bodies of the university, which shall be final and binding.	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**		**REGISTRAR** **VICE-CHANCELLOR**

MASTER OF SCIENCE (Audiology)

Existing CBCS SCHEME (MODEL QUESTION PAPER PATTERN)

(All Units are Compulsory)

Paper Title: …… Max. Marks 50

Paper Code: …….

Unit No.	Question Number	Question/s	Marks
I	1)	A x x x x x x x x x x x x x x x x x x x OR	10

	2 (a) 2 (b)	B x x x x x x x x x x x x x x x x x x x C x x x x x x x x x x x x x x x x x x x	05 05
II	3 (a) 3 (b) 4)	D x x x x x x x x x x x x x x x x x x x E x x x x x x x x x x x x x x x x x x x OR F x x x x x x x x x x x x x x x x x x x	10 05 15
III	5 (a) 5 (b) 5 (c) 6 (a) 6 (b)	G x x x x x x x x x x x x x x x x x x x H x x x x x x x x x x x x x x x x x x x I x x x x x x x x x x x x x x x x x x x OR J x x x x x x x x x x x x x x x x x x x K x x x x x x x x x x x x x x x x x x x	05 05 05 10 05
IV	7 (a) 7 (b) 7 (c) 8)	L x x x x x x x x x x x x x x x x x x x M x x x x x x x x x x x x x x x x x x x N x x x x x x x x x x x x x x x x x x x OR O x x x x x x x x x x x x x x x x x x x	05 03 02 10

Regulation: For a theory paper carrying 50 marks, each full question shall carry either 10 or 15 marks, with internal choices having equal marks. Each **15** question can be divided as follows: **15, 10+5, 5+5+5** and each **10** question can be divided as follows: **10, 5+5, 5+3+2**. Maximum number of subdivision in a question shall be THREE.

REGISTRAR **VICE-CHANCELLOR**

MASTER OF SCIENCE (Audiology)

Proposed CBCS SCHEME (MODEL QUESTION PAPER PATTERN)

(All Units are Compulsory)

Course Title: …… Max. Marks 50

Course Code: …….

Unit No.	**Question Number**	**Question/s**	**Marks**
I	1) 2 (a)	A x x x x x x x x x x x x x x x x x x x OR B x x x x x x x x x x x x x x x x x x x	10 05

	2 (b)	C x x x x x x x x x x x x x x x x x x x	05
II	3 (a) 3 (b) 4)	D x x x x x x x x x x x x x x x x x x x E x x x x x x x x x x x x x x x x x x x OR F x x x x x x x x x x x x x x x x x x x	10 05 15
III	5 (a) 5 (b) 5 (c) 6 (a) 6 (b)	G x x x x x x x x x x x x x x x x x x x H x x x x x x x x x x x x x x x x x x x I x x x x x x x x x x x x x x x x x x x OR J x x x x x x x x x x x x x x x x x x x K x x x x x x x x x x x x x x x x x x x	05 05 05 10 05
IV	7 (a) 8)	L x x x x x x x x x x x x x x x x x x x OR O x x x x x x x x x x x x x x x x x x x	10 10

Regulation: For a theory paper carrying 50 marks, each full question shall carry either 10 or 15 marks, with internal choices having equal marks. Each ***15 mark question*** can be divided as subsection not exceeding 3 subdivisions. **Any two of the four units could have questions for 15 marks each. The remaining two units will have weightage of 10 marks each.**

REGISTRAR **VICE-CHANCELLOR**

Existing M.Sc. (Audiology) CBCS and CAGP Regulations - 2013

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**	*Technology for Speech-Language & Hearing* ***OR*** *Clinical Counseling* ***OR*** *Speech Production* ***OR*** *Diseases of the ear and auditory pathway*
	1.6*	0:0:4	4		C=4x4=16^	16		HCC	Clinical Practicum I
II	2.1	2:1:0	3	20	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**	*Vestibular system: assessment & management* ***OR*** *Clinical Neuropsychology* ***OR*** *Clinical Behavior Analysis*
	2.5	(4 credits)	4			3		OE	
	2.6*	0:0:4	4		C=4x4=16^	16		HCC	Clinical PracticumII
	2.7*	0:0:1	1		C=4x1=4^	4		SCC	Clinical Practicum III

Existing M.Sc. (Audiology) CBCS and CAGP Regulations - 2013

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 IV
	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 V
	4.5	D	6		D=1x6=6	5+1^		HC	Dissertation
				77					

***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**

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

Sl. No.	Course No.	Credit L:T:P	Credits	Total Credits	No. of Hrs (Hr x Cr = Hr)	No. of Hrs/wk	Total hrs/Wk	HC/ SC /OE	Title of the Course
I	1.1	2:1:0	3	18	L=1x2=2 T=2x1=2	4	35	HC	Research methods and Statistics in Speech-Language & Hearing
	1.2	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Auditory Perception
	1.3	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Physiological Assessment of the Auditory System
	1.4 a 1.4 b	2:1:0	**3**		**L=1x2=2 T=2x1=2**	**4**		**SC**	**Auditory Physiology OR Technology for Speech-Language & Hearing**

	1.5 a 1.5 b	1:1:0	**2**		L=1x1=1 T=2x1=2	3		**SC**	Diseases of the ear and auditory pathway **OR** Clinical Counselling
	1.6*	0:0:4	4		C=4x4=16^	16		**HC**	Clinical Practicum I
II	2.1	2:1:0	3	20	L=1x2=2 T=2x1=2	4	39	HC	Psychophysics of Audition
	2.2	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Electrophysiological Assessment of the Auditory System
	2.3 a 2.3 b	2:1:0	**3**		**L=1x2=2** **T=2x1=2**	**4**		**SC**	**Neurophysiology of Hearing** **OR** ***Speech Production***
	2.4 a 2.4 b	1:1:0	2		L=1x1=1 T=2x1=2	3		**SC**	**Age related changes in audio-vestibular system** **OR** Clinical Behavior Analysis
	2.5	(4 credits)	4			4		OE	
	2.6*	0:0:4	4		C=4x4=16^	16		**HC**	Clinical Practicum II
	2.7 a 2.7 b 2.7 c	0:0:1	1		C=4x1=4^	4		**SC**	**Examination of ear with different pathology** **OR** **Speech synthesis** **OR** **LD evaluation and therapy**

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

Sl. No.	**Course No.**	**Credit L:T:P**	**Credits**	**Total Credits**	**No. of Hrs (Hr x Cr = Hr)**	**No. of Hrs/wk**	**Total hrs/Wk**	**HC/ SC /OE**	**Title of the Course**
III	3.1	2:1:0	3	21	L=1x2=2 T=2x1=2	4	40	HC	Implantable Devices for individuals with hearing impairment
	3.2	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Speech Perception
	3.3	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Seminars in assessment of hearing impairment
	3.4	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Seminars in Rehabilitative Audiology
	3.5 a	2:1:0	**3**		L=1x2=2	**4**		**SC**	**Vestibular system:**

	3.5 b 3.5 c				T=2x1=2				**assessment & management OR Auditory Physiology** OR Technology for Speech-Language & Hearing****
	3.6*	0:0:4	4		C=4x4=16^	16		**HC**	Clinical Practicum III
	3.7*******	D	**2**		**D=2x2=4^**	3+1^		**SC**	**Dissertation in Basic Hearing Sciences-I OR Dissertation in Audiological Evaluation-I OR Dissertation in Rehabilitative Audiology-I**
IV	4.1	2:1:0	3	17	L=1x2=2 T=2x1=2	4	33	HC	Assessment and Management of Central Auditory Processing Disorders
	4.2	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Audiology in Practice
	4.3	2:1:0	3		L=1x2=2 T=2x1=2	4		HC	Speech Perception in Clinical Population
	4.4*	0:0:4	4		C=4x4=16^	16		**HC**	Clinical Practicum IV
	4.5*******	D	**5**		**D=1x4=4^**	4+1^		**SC**	**Dissertation in Basic Hearing Sciences-II OR Dissertation in Rehabilitative Audiology-II OR Dissertation in Audiological Evaluation-II**
				76			***147***		

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

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

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

^ One hour each would be used for CC/JC

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

Please note:

L: One hour of lecture = 1 credit
T: Two hours of tutorials = 1 credit
P: Four hours of clinical practicum = 1 credit
D: Dissertation

REGISTRAR **VICE-CHANCELLOR**

UNIVERSITY OF MYSORE

M.Sc. (Audiology) 2016 – Syllabus

	I Semester	
	Existing	***Proposed***
	88001 Research Methods and Statistics in Speech-Language & Hearing	**Research Methods and Statistics in Speech-Language & Hearing**
	Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
	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***	**Objectives** **After successful completion of this course the students should be able to:** 1. Understand and deduce the use of research methods. 2. Choose appropriate research designs to

	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***	carry out research in the field. 3. **Apply** statistics in the field of Speech-Language Pathology and Audiology. **4.** Critically evaluate the research designs and **statistics in research publications.**
	Unit 1 • 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 1 : Research strategies and their statistical counterpart 18 Hrs** 1.1 Overview of **variables** • **Dependent** • **Independent** o **Active and attribute** o **Continuous and categorical variables** • **Extraneous and control variables** **1.2 Quantitative Research** • **Experimental research** o **Bivalent** o **Multivalent** o **Parametric** • **Descriptive research** o **Comparative research** o **Developmental research** o **Correlational research** o **Survey research** o **Retrospective research** • **Combined experimental and descriptive research** **1.3. Qualitative research** • **Observational research** • **Interview research** • **Narrative research** • **Case study research** **1.4. Documentation** • **Organization** • **Formatting** • **Writing style: Theses and journal articles**

	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 2 : Research designs 18 Hrs** 2.1 Group designs • **Within group** • **Between group** • **Mixed designs** 2.2 Single subject designs • **Withdrawal and reversal design** • **Multiple base line** • **Changing criterion design** **2.3 Treatment Designs** • **Pre-experimental** • **Quasi experimental** • **True experimental** **2.4 Evidence based practice** • **Generalization of research findings** • **Levels of evidence** • **Barriers to evidence-based practice** **2.5 Validity of research designs** • **Internal validity** • **External validity**
	Unit 3 • 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) • 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 3: Parametric tests and its application 18 Hrs** 3.1 Overview of basic statistics • **Measures of central tendency** • **Measures of dispersion** • **General properties of normal distribution** • **Variants from normal distribution** • Methods of correlation 3.2 Simple and **multiple** linear regression (with numerical examples) 3.3 Hypotheses and testing of hypotheses 3.3 Testing the significance between two means (with numerical examples) • Independent samples t-test • Paired sample t-test 3.4 Analysis of variance (ANOVA) • Types of ANOVA • Basic model

		• Assumptions underlying ANOVA • One-way and two-way ANOVA (with numerical examples) • Need for Post-hoc tests • Concept of repeated measures ANOVA and ANCOVA 3.5 Multivariate data analysis (concept only) • Need for multivariate data analysis • Introduction to various methods o Principal component analysis o Cluster analysis o Discriminant analysis o 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	**Unit 4: Non-parametric tests, qualitative data analyses and their application 18 Hrs** 4.1 Consequences of failure of assumptions underlying parametric tests 4.2 Need for transformations and non-parametric tests 4.3 Non-parametric tests for independent samples (with numerical examples) • Median test • Mann-Whitney U test • Kruskal-Wallis test 4.4 Non-parametric tests for related samples (with numerical examples) • Sign test • Wilcoxon's signed-rank test • Friedman's test 4.5 Analysis of qualitative data (with numerical examples) • Contingency tables • Chi-square test for independence of attributes • Measures of Association-contingency coefficient and Cramer's • Measures of agreement - Kappa coefficient
	PRACTICUM	

		1. Review research methods and statistics used in publications in the field of communication disorders in blocks of 5 years from 1970. **2. Two journal articles should be reviewed by each student for variables, research methods and appropriateness of statistics.**
REFERENCES		
	Existing	***Proposed***
	Unit 1: 1. Grosof. M.S., Sardy. H. (1985). A research primer for the social & behavioral sciences. New York: Academic Press. 2. Hegde, M.N. (1987). Clinical Research in Communicative Disorders. Principles and Strategies, Boston,. College-Hill Press. 3. Hegde, M.N. (1994). Clinical Research in Communicative Disorders. Principles and Strategies, Austin, ProEd. 4. Lindlof (1995). Qualitative communication research methods, California, Sage publications. 5. Maxwellsatake (1997). Research and statistical methods in communication disorders, Baltimore, Williams & Wilkins. 6. Pannbaker M.H. (1994). Introduction to clinical research in communication disorders, Sandiego, Singular publishing group. 7. Schiavetti Metz (1997). Evaluating research in communication disorders, Boston, Allyn & Bacon. 8. Tucker (1981). Research in speech communication, Prentice Hall. Inglewood cliffs. 9. Ventry. I. M.& Schiavetti N. (1980). Evaluating research in speech pathology and Audiology, London. Addison Wesley.	**Unit 1: Research strategies and their statistical counterpart 18 Hrs** 1. Grosof, M.S., & Sardy, H. (1985). A research primer for the social & behavioral sciences. New York: Academic Press. 2. Hegde, M.N. (2003). Clinical Research in Communicative Disorders. Principles and Strategies, Boston: College-Hill Press. 3. Hegde, M.N. (1994). Clinical Research in Communicative Disorders. Principles and Strategies. Austin: ProEd. 4. Lindlof (1995). Qualitative communication research methods. California: Sage Publications. 5. Maxwellsatake (1997). Research and statistical methods in communication disorders. Baltimore: Williams & Wilkins. 6. Pannbaker, M.H. (1994). Introduction to clinical research in communication disorders. San Diego: Singular Publishing Group. 7. Schiavetti, N., Metz, D.E., & Orlikoff, R.F. (1997). Evaluating research in communication disorders. Boston: Allyn & Bacon. **8. Orlikoff, R. F., Schiavetti, N., & Metz, D. E. (2015). Evaluating Research in Communication Disorders. New York: Pearon.** 9. Tucker (1981). Research in speech

		communication. Inglewood Cliffs: Prentice Hall. 10. Ventry, I. M., & Schiavetti, N. (1980). Evaluating research in speech pathology and Audiology. London: Addison Wesley.
	Unit 2: 1. Broota (1989). Experimental design in behavioral research. Eastern New Delhi, Wiley. Doehring (1988). Research strategies in human communication disorders, Austin, ProEd. 2. Frey (1991). Investigating communication. An introduction to research methods. Inglewood cliffs, Prentice Hall. 3. Silverman F.H. (1985). Research design and evaluation in speech language pathology, Audio logy. Asking questions & answering, New Jersy, Prentice Hall. 4. Silverman, F.N. (1988) Research designs in speech pathology and audiology. Boston. Allyn & Bacon.	**Unit 2: Research design** 1. Broota (1989). Experimental design in behavioral research. Eastern New Delhi, Wiley. Doehring (1988). Research strategies in human communication disorders. Austin: Proed. 2. Frey (1991). Investigating communication. An introduction to research methods. Inglewood Cliffs: Prentice Hall. 3. Silverman, F.H. (1985). Research design and evaluation in speech language pathology, Audiology. Asking questions & answering. New Jersey: Prentice Hall. 4. Silverman, F.N. (1988) Research designs in speech pathology and audiology. Boston: Allyn & Bacon. 5. **Haynes, W. O., & Johnson, C. (2009). Understanding Research and Evidence based practice in communication disorders. Boston: Pearson.**
	Unit 3 ***1. Abhaya, I, Sanjeev, B.S, (2001). Medical Biostatistics, Marcel Dekkar, Inc, New York*** ***2. Edwards, A.L. (1973). Statistical methods for behavioral sciences, 3rd Ed. New York: Holt Rinehart.*** ***3. Fry (2002). Biological Data Analysis, Oxford University Press, New York*** 4. Garrett, E.H. (1969). Statistics in Psychology and Education. Bombay: Wakils Feffer. ***5. Goodman, R (1972). Teach yourself statistics, English Language Book Society and The English Universities***	**Unit 3: Parametric tests, qualitative data** **1. Argyrous, G. (2014). Statistics for Research. 2nd Ed. New Delhi: SAGE Publications (SA).** **2. Cox, T.F. (2014). An Introduction to Multivariate Data Analysis. New Delhi: Wiley India (P) Ltd.** **3. Gupta, K.R. (2014). Statistics. Vol. 1. New Delhi: Atlantic Publishers & Distributors (P) Ltd.** **4. Gupta, K.R. (2014). Statistics. Vol. 2. New Delhi: Atlantic Publishers & Distributors (P) Ltd.** **5. Field, A. (2013). Discovering**

	Press Ltd., London ***6. Guilford (1978). Fundamental Statistics in Psychology Education. Tokyo: McGraw Hill.*** ***7. Howell (1999). Fundamental statistics for the behavioral science. Boston: Duxbury Press.*** ***8. Jane, Nigel (2003). Understanding Social statistics, Sage publications, London*** 9. Johnsonwichern (1992). Applied multivariate statistical analysis. New Jersey: Prentice Hall. ***10. Kanji (1999): 100 Statistical tests. London: Sage publications..*** 11. Michael, S. L. (Editor) (1993): Regression Analysis – International hand books of quantitative applications in the social sciences, Vol 2, Sage Publications, London ***12. Philip, H. D. (1965). An introduction to psychological statistics, Harper and Row, New York*** ***13. Sancheti , Kapoor (1981) . Statistics : Theory, Methods and Application, Sultanchand and sons, New Delhi*** ***14. Steven (1996), Statistical analysis of Epidemiologic Data, Oxford University Press, Oxford.*** ***15. Thompson, B (2006). Foundations of behavioral statistics – An insight-based approach, The Guilford Press, New York***	**Statistics using IBM SPSS Statistics. 4th Ed. New Delhi: SAGE Publications.** **6. Martin, W.E., & Bridgmon, K.D. (2012). Quantitative and Statistical Research Methods – From Hypothesis to Results. San Francisco: Jossey – Bass.** **7. Kapur, S.K. (2008). Elements of Practical Statistics. 3rd Ed. New Delhi: Oxford & IBH Publishing Co.** **8. Maxwell, D.L., & Satake, E. (2006). Research and Statistical Methods in Communication Sciences and Disorders. Canada: Thomson Publications.** **9. Salkind, N.J. (2000). Statistics for people who (think they) hate statistics. California: SAGE Publications.** **10.** Michael, S.L. (Editor) (1993). Regression analysis – International handbooks of quantitative applications in the social sciences. Vol. 2. London: Sage Publications. **11.** Johnsonwichern (1992). Applied multivariate statistical analysis. New Jersey: Prentice Hall. **12.** Garrett, H.E., & Woodworth, R.S. (1979). Statistics in Psychology and Education. 9th Ed. Bombay: Feffer & Simons. **13. Gupta, S.P. (1977). Practical Statistics. 3rd Ed. New Delhi: S. Chand & Company Ltd.**
	Unit 4 1. Chris, L (1979)– Introduction to Statistics – A Non-parametric approach for the social sciences, John Wiley & Sons, New York. ***2. Goodman, R (1972). Teach yourself statistics, English Language Book Society and The English Universities Press Ltd., London*** 3. Gibbon (1993). Nonparametric	**Unit 4: Non-parametric tests, qualitative data analyses and their application** **1. Argyrous, G. (2014). Statistics for Research. 2nd Ed. New Delhi: SAGE Publications.** **2. Gupta, K.R. (2014). Statistics – Vol. 2. New Delhi: Atlantic Publishers & Distributors (P) Ltd.** **3. Field, A. (2013). Discovering**

	statistics – An introduction. London: Sage publications 4. ***Kanji (1999): 100 Statistical tests. London: Sage publications..*** 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.	**Statistics using IBM SPSS Statistics. 4th Ed. New Delhi: SAGE Publications** **4. Martin, W.E., & Bridgmon, K.D. (2012). Quantitative and Statistical Research Methods – From Hypothesis to Results. San Francisco: Jossey – Bass.** **5. Kapur, S.K. (2008). Elements of Practical Statistics. 3rd Ed. New Delhi: Oxford & IBH Publishing Co.** **6.** Gibbons, J.D. (1993). Non-parametric Statistics: An Introduction. California: Sage Publications **7.** Leach, C. (1979). Introduction to Statistics – A Non-parametric approach for the social sciences. New York : John Wiley & Sons **8. Gupta, S.P. (1977). Practical Statistics. 3rd Ed. New Delhi: S.Chand & Company Ltd.** **9. Ferguson, G.A. (1976). Statistical Analysis in Psychology and Education. Tokyo: McGraw-Hill Kogakusha, Ltd.** **10.** Seigal, S. (1956). Non-parametric Statistics for the Behavioral Sciences. Tokyo: McGraw Hill.

	Existing	*Proposed*
	88003: Basics in Auditory Perception	**Auditory Perception**
	Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
	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.***	**Objectives** **After studying this course student will be familiarized:** **1. With various psycho-acoustical procedures used for assessing the functions of auditory system,** **2. With the effects of sensori neural hearing loss of varying degrees and configuration on different psycho-acoustic tasks.** **3. With outcomes and implications of these psycho-acoustic tasks.** **4. With analyses and interpretation of results from psychophysical experiments**
	Unit 1: Introduction • ***Introduction to*** signal Generation and ***Modifications of Acoustic Signals*** • Theory of Signal Detection: basic concepts and application • Psychophysical Methods: Classical and	**Unit 1:** Introduction **to Psycho-Acoustics** **18 Hrs** **1.1 Physical description and parameters for** generation of sounds • **Sine wave and complex signals** • **Analysis of sound: Spectrum and spectrogram, LTASS**

	adoptive	• **Filters and their properties** **1.2** Theory of signal detection • Basic concepts • Applications **1.3** Psychophysical methods • Classical methods • Adaptive methods
	Unit 2 • Absolute and relative measures - ***Concepts*** - Methods of measuring absolute and relative (Difference Limen) • Loudness - Minimum audible pressure, Minimum audible field, equal loudness contours - Loudness scaling: phones &Sones - loudness growth ***and psychophysical power law*** - ***Loudness of complex signals*** - Difference limen for Intensity • ***Pitch*** - Pitch Scales - ***Factors effecting pitch perception*** - Pitch of complex signals - Theories of pitch Perception - ***Ohm's acoustic law*** - ***Consonance, dissonance and Musical intervals*** - ***Combination tones*** - Difference limen for frequency	**Unit 2: Absolute and Relative Thresholds 18 Hrs** **2.1 Overview of** absolute and relative measures • Methods of measuring absolute and relative **threshold (**Difference limen **for physical parameters of sound)** • **Thresholds of audibility (MAP & MAF)** **2.2** Loudness **perception in individuals with normal hearing and in individuals with hearing impairment (different degrees, configuration and types)** • **Dynamic range of hearing,** equal loudness contours and loudness scaling. • Models of loudness. • **Factors affecting loudness: Bandwidth, duration, adaptation and masking.** • DLI • **Recruitment and softness imperception** • **Consequences of altered loudness perception** **2.3 Pitch perception in individuals with normal hearing and in individuals with hearing impairment (different degrees, configuration and types)** • Theories of pitch perception • Pitch Scales • **Perception of pure-tones** o Frequency discrimination o **Pitch perception of pure-tones** o **Effect of intensity on pitch** • **Perception of complex signals** o Theories of pitch perception for

		complex signals o **Missing fundamental** o **Discrimination of complex tones** • **Consequences of altered pitch perception**
	Unit 3 • **Basic concepts of temporal processing** - **Temporal resolution** - **Temporal integration** • **Detection of Gaps** - **Broad band noise** - **Narrow band noise** - **Sinusoids** - **Discrimination of Gaps** • **Temporal modulation transfer function** - **Broad band noise** - **Narrow band noise** - **Sinusoids** - **Discrimination of Modulation Frequency** • **Auditory Pattern perception** - **Timber Perception and Object Identification** - ***Time invariant-Pattern and Timber*** - ***Time varying Patterns***	**Unit 3: Frequency selectivity in individuals with normal hearing and in individuals with hearing impairment (different degrees, configuration and types) 18 Hrs** **3.1 Measurement of frequency sensitivity using masking experiments** • **Critical band concept and power spectrum model.** • **Estimating the shape of auditory filter** o **Psycho-physical tuning curve** o **Notched noise** o **Non-simultaneous masking** • **Masking patterns and excitation patterns.** **3.2 Non-peripheral masking phenomena** • **Central masking** • **Informational masking** • **Overshoot phenomena** • **Co-modulation masking release** **3.3 Consequences of reduced frequency selectivity**
	Unit 4 - Auditory object Perception • **Basic concepts in auditory object** • **Separation** • **Spectral separation** • **Spectral profile** • **Harmonicity / Temporal regularity** • **Spatial separation** • **Temporal Separation** • **Temporal Onset and Offset** • **Temporal Modulation**	**Unit 4: Temporal processing in individuals with normal hearing and in individuals with hearing impairment (different degrees, configuration and types) 18 Hrs** **4.1 Overview of temporal processing** • **Temporal resolution** • **Temporal integration** • **Models of temporal processing** **4.2 Detection and discrimination of gaps in** • **Broad band noise** • **Narrow band noise** • **Sinusoids**

		4.3 Temporal modulation transfer function using • **Broad band noise** • **Narrow band noise** • **Sinusoids** **4.4 Discrimination of modulation frequency** **4.5 Consequences of altered temporal processing**
	PRACTICUM	
	Existing	***Proposed***
		• **Generation of sinusoid and complex signals, LTASS of complex signals.** • **Measure loudness curve/growth function (Magnitude scaling), growth of masking on 5 individuals with normal hearing.** • **Measure temporal integration on 5 individuals with normal hearing.** • **Measure TMTF on 5 individuals with normal hearing.** • **Carry out non simultaneous masking on 5 individuals with normal hearing.** • **Measure PTC on 2 individuals with normal hearing.**

<table>
<tr><th colspan="3">REFERENCES</th></tr>
<tr><td></td><td>Existing</td><td>Proposed</td></tr>
<tr><td></td><td>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. San Diego: 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. USA: Oxford University Press.
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</td><td>Unit 1: Introduction to psycho-acoustics

1. Gelfand, S, A. (2005). Introduction to psychological and physiological acoustics. New York: Marcel Dekker.
2. Moore, B. C. J. (1995). Hearing. San Diego: Academic Press.
3. Moore, B. C. J. (1997). Introduction to psychology of hearing, San Diego: Academic Press.
4. Pickles. J.O. (2008). Introduction to Physiology of Hearing. San Diego: Academic Press.
5. Warren, R. M. (2008). Auditory Perception: An Analysis and Synthesis. Cambridge: Cambridge University Press.
6. Yost, W. A. (1994). Fundamentals of hearing: An introduction. San Diego: Academic Press.
7. Zwicker, E., & Fastl, H. (1999). Psychoacoustics-Facts and models. Springer Verlag: Berlin Heidelberg.
8. Stuart Rosen & Deter Howell (1991). Signals and systems for speech and hearing. CA: Academic Press Inc. (Chapters 2, 3, 6, 7, 8, 9, 10 and 12).

Unit 2: Absolute and relative thresholds

1. Gelfand, S, A. (2005). Introduction to psychological and physiological acoustics. New York: Marcel Dekker.
2. Moore, B. C. J. (1995). Hearing. San Diego: Academic Press.
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</table>

	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). 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.	5. Warren, R. M. (2008). Auditory Perception: An Analysis and Synthesis. Cambridge: Cambridge University Press. 6. Yost, W. A. (1994). Fundamentals of hearing: An introduction. San Diego: Academic Press. 7. Zwicker, E., & Fastl, H. (1999). Psychoacoustics-Facts and models. Springer Verlag: Berlin Heidelberg. 8. **Plack, C.J., Oxenham, A.J., & Fay, R.R. (2005).** Pitch: Neural Coding and Perception. New York: Springer. 9. Brain, C.J. Moore (1998). Cochlear Hearing Loss. (2nd and 3rd Editions). London: Whurr Publishers. 10. Brain C.J., Moore (2007). Cochlear Hearing Loss: Physiological, Psychological and Technical Issues. England: John Wiley and Sons Ltd. **Unit 3: Frequency selectivity in individuals with normal hearing and in individuals with hearing impairment (different degrees, configuration and types)** 1. Gelfand, S, A. (2005). Introduction to psychological and physiological acoustics. New York: Marcel Dekker. 2. Moore, B. C. J. (1995). Hearing. San Diego: Academic Press. 3. Moore, B. C. J. (1997). Introduction to psychology of hearing. San Diego: Academic Press. 4. Pickles, J.O. (2008). Introduction to Physiology of Hearing. San Diego: Academic Press. 5. Warren, R. M. (2008). Auditory Perception: An Analysis and Synthesis. Cambridge: Cambridge University Press. 6. Yost, W. A. (1994). Fundamentals of hearing: An introduction. San Diego: Academic Press. 7. Zwicker, E., & Fastl, H. (1999). Psychoacoustics-Facts and models. Springer: Verlag Berlin Heidelberg.

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		Unit 4: Temporal processing in individuals with normal hearing and in Individuals with hearing impairment (different degrees, configuration and types) 1. Gelfand, S, A. (2005). Introduction to psychological and physiological acoustics. New York: Marcel Dekker. 2. Moore, B. C. J. (1995). Hearing. San Diego: Academic Press. 3. Moore, B. C. J. (1997). Introduction to psychology of hearing, San Diego: Academic Press. 4. Pickles. J.O. (2008). Introduction to Physiology of Hearing. San Diego: Academic Press. 5. Warren, R. M. (2008). Auditory Perception: An Analysis and Synthesis. Cambridge: Cambridge University Press. 6. Yost, W. A. (1994). Fundamentals of hearing: An introduction. San Diego: Academic Press. 7. Zwicker, E., & Fastl, H. (1999). Psychoacoustics-Facts and models. Springer-Verlag: Berlin Heidelberg. 8. Brain, C.J. Moore (1998). Cochlear Hearing Loss. (2nd and 3rd Editions). London: Whurr Publishers. 9. Brain C.J. Moore (2007). Cochlear

		Hearing Loss: Physiological, Psychological and Technical Issues. England: John Wiley and Sons Ltd. 10. Oxenham, A., & Bacon, S. (2003). Cochlear Compression: Perceptual Measures and Implications for Normal and Impaired Hearing. *Ear and Hearing*, 24, 350-366. 11. Stanley, A. Gelfand (1998). Hearing. New York: Marcel Dekker Inc.

	Existing	***Proposed***
	88004 Physiological Assessment of the Auditory System	**Physiological Assessment of the Auditory System**
	Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100

	Objectives **After going through this subject, the student shall be able to describe:** ***1. Describe the bases of electr-ophysiological 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***	**Objectives** **After completing this course, the candidate shall be able to** 1. Describe the bases of physiological tests 2. Independently administer different physiological tests, interpret the findings 3. Make need-based modifications in the test protocol 4. Prepare research proposal to conduct research in the domain of physiological tests
	Unit 1 – Tympanometry • Principle and instrumentation of immittance evaluation • Tympanometry: Low frequency Vs. Multi-frequency tympanometry, • Single vs. Multi-component tympanometry, • Variables effecting tympanpmetry • Tympanometry in infants • ***Tests used to assess Eustachian tube function*** • Implication of tympanometric evaluation in differential diagnosis and management	**Unit 1: Tympanometry** **18 Hrs** **1.1 Overview of p**rinciples and instrumentation of immittance evaluation **1.2 Overview on Single component tympanometry and its applications** **1.3 Multi-frequency and** multi-component tympanometry **1.4** Variables affecting multiple component and multi-frequency tympanometry **1.5** Tympanometry in infants **1.6** Implication of tympanometric evaluation in differential diagnosis and management **1.7 Wideband reflectance/absorbance and wideband tympanometry: Bases, instrumentation, test administration, interpretation and clinical applications**
	Unit 2 - Reflexometry • **Acoustic and non-acoustic reflexes,** • **Reflex adaptation, latency of acoustic reflex, reflex averaging, reflex sensitization** • **Temporal summation of acoustic reflex, binaural summation of**	**Unit 2 - Reflexometry** **18 Hrs** **2.1 Overview of Acoustic reflexes: pathway, test protocol, administration and clinical implications** **2.2 Reflex patterns in different pathologies** **2.3 Overview on special tests of acoustic**

	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.	**reflexes and their applications:** Reflex adaptation, latency of acoustic reflex, reflex averaging, reflex sensitization, Temporal summation of acoustic reflex, binaural summation of acoustic reflex **2.4** Variables affecting their measurement of acoustic reflexes **2.5** Importance of high frequency reflexometry in paediatric assessment **2.6** Reflectometry **2.7** Non-acoustic reflexes: **pathway, test protocol, administration and clinical implications** **2.8** Research needs **in middle ear muscle reflexes**
	Unit 3: Otoacoustic emissions • 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 • Clinical applications of SOAE • Suppression of SOAE	**Unit 3: Otoacoustic emissions 18 Hrs** 3.1 Origin of OAEs 3.2 Classifications of OAEs **with special focus on mechanism based taxonomy** 3.3 Principles and recording techniques of different types of OAEs 3.4 Interpretation of OAEs: amplitude, latency, phase, and reproducibility 3.5 Instrumentation of SOAE 3.6 Recording of SOAE 3.7 Synchronized SOAE 3.8 Factors affecting SOAE 3.9 SOAE & tinnitus 3.10 Clinical applications of SOAE 3.11 Suppression of SOAE
	Unit 4: Evoked otoacoustic emission • Instrumentation of TEOAE/DPOAE/SFOAE • Recording of TEOAE/DPOAE/SFOAE • Factors affecting TEOAE/DPOAE/ SFOAE • Evoked OAEs & Tinnitus • Clinical applications of TEOAE/	**Unit 4: Evoked oto-acoustic emission 18 Hrs** 4.1 Instrumentation of TEOAE/DPOAE /SFOAE 4.2 **Techniques for** recording TEOAE/ DPOAE/SFOAE 4.3 Factors affecting TEOAE/DPOAE/ SFOAE

	DPOAE/SFOAE • Contralateral & ipsilateral suppression of TEOAE/DPOAE/SFOAE • Implication in differential diagnosis and management, **Research needs in OAE**	4.4 **Fine structure DPOAEs** 4.5 Evoked OAEs & tinnitus 4.6 Clinical applications of TEOAE/ DPOAE /SFOAE 4.7 Contralateral & ipsilateral suppression of TEOAE/DPOAE/SFOAE: **Procedure & applications** 4.8 Implications in differential diagnosis and management 4.9 Research needs in OAEs
	PRACTICUM	
	Existing	***Proposed***
		• **Immittance evaluation** • **Draw vector plots for** ▪ **middle system at resonance,** ▪ **mass dominated middle ear system** ▪ **Stiffness dominated middle ear system** • **Measure admittance in the calibration cavities of various volumes and note down the observations** • **Calculate Equivalent ear canal volume by measuring static admittance in an uncompensated tympanogram (10 ears)** • **Record tympanogram in the manual mode and measure peak pressure, peak admittance and ear canal volume manually using cursor (5 ears).** • **Interpret hypothetical case results indicating the presence of various middle ear pathologies (5 cases)** • **Vary different stimulus and procedure related parameters and measure tympanogram to witness their effects. Few of the mandatory parameters are, probe tone frequency, rate of pressure change, direction of pressure change, number of trials, probe insertion depth, sneezing before measurement, speaking while measurement (5 ears)** • **Carry out Acoustic reflex decay test and quantify the decay manually using cursor (5 individuals).**

		• **OAEs** • **Setting protocol for recording TEOAEs and DPOAEs** • **Record TEOAEs, SFOAE, SOAE and DPOAE and note down the amplitude, SNR, noise floor and reproducibility at octave and mid-octave frequencies. Note down the stimulus stability and the overall SNR (3 ears each).** • **Record ipsilateral and contralateral suppression of TE and DPOAEs and note down the suppression magnitudes**
	REFERENCES	
	Existing	***Proposed***
	Unit 1 & 2 1. Gelfand, S. A. (2009). *Essentials of Audiology*. Thieme 2. Feldman, A S. & Wilber L A. (1976). Acoustic immitance & admittance. Williams & Wilkins Comp 3. Jerger, J (1975). Hand book of clinical impedance audiometry, American Publisher Electromedics Corp. 4. Silman, S. & Silverman, C.A.(1991). Auditory Diagnosis: Principles & Applications, San Diego, Academic Press. 5. Wiley, T.L. and Fowler, C.G. (1997). *Acoustic immittance measures in clinical audiology: A primer.* San Diego: Singular Publishing Group, Inc. 6. Hunter, L., & Shahnaz, N. (2013). *Acoustic Immittance Measures: Basic and Advanced Practice* (1 edition). San Diego, CA: Plural Publishing. 7. Katz, J., Medwetsky, L., Burkard, R. F., & Hood, L. J. (Eds.). (2007). *Handbook of Clinical Audiology* (6th revised North American ed edition). Philadelphia: Lippincott Williams and Wilkins. 8. Musiek, F. E., & Rintelmann, W. F. (1999). *Contemporary Perspectives in*	**Unit 1 & 2: Tympanometry, Reflexometry** 1. Gelfand, S. A. (2009). *Essentials of Audiology*. New York: Thieme Medical Publishers. 2. Feldman, A. S., & Wilber, L. A., (1976). Acoustic immitance & admittance. Baltimore: Williams & Wilkins Com. 3. Jerger, J. (1975). Hand book of clinical impedance audiometry. Hudson, New Hampshire: American Publisher Electromedics Corp. 4. Silman, S., & Silverman, C.A. (1991). Auditory Diagnosis: Principles & Applications. San Diego: Academic Press. **5.** Wiley, T.L., & Fowler, C.G. (1997). *Acoustic immittance measures in clinical audiology: A primer.* San Diego: Singular Publishing Group Inc. **6. Hunter, L., & Shahnaz, N. (2013). *Acoustic Immittance Measures: Basic and Advanced Practice* (1st Edn). San Diego: CA: Plural Publishing.** **7. Katz, J., Medwetsky, L., Burkard, R. F., & Hood, L. J. (Eds.). (2007). *Handbook of Clinical Audiology* (6th revised North American edition). Philadelphia: Lippincott: Williams and Wilkins.**

	Hearing Assessment. Boston: Pearson. 9. Roeser, R. J., Valente, M., & Hosford-Dunn, H. (2007). *Audiology: Diagnosis*. Thieme.	**8. Musiek, F. E., & Rintelmann, W. F. (1999). *Contemporary Perspectives in Hearing Assessment*. Boston: Pearson.** **9. Roeser, R. J., Valente, M., & Hosford-Dunn, H. (2007). *Audiology: Diagnosis*. New York: Thieme Medical Publishers.**
	Unit 3 &4 1. Berlin, C.I. (Ed.) (1996). *Hair cells and hearing aids*. London: Singular publishing group. 2. Berlin, C. I., Hood, L. J., and Ricci, A. (2002). Hair Cell Micromechanics and Otoacoustic Emissions. Thomson Learning Inc., New York. 3. Hall, J. W. (2000). Handbook of Otoacoustic Emissions. Singular Publishing Company, San Diego. 4. Musiek, F. E., and Rintelmann, W. F. (1999). Contemporary Perspectives in Hearing Assessment. Allyn and Bacon, Boston. 5. Robinette, M. S., and Glattke, T. J. (2007). Otoacoustic Emissions: Clinical Applications (3rd edition). Thieme Publishers, New York. 6. Roeser, R. J., Valente, M., and Dunn, H. H. (2007). Audiology: Diagnosis. Thieme Publishers, New York. 7. Christopher. A.Shera (2004) Mechanism for mammalian OAE and their implication for the clinical utility of OAE. Ear & Hearing, Vol.25, No.2. 8. Joint Committee on Infant Hearing. (2007). Year 2007 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs. Pediatrics, 120, 898-921. 9. Hall, J. W. & Sumitrajit, D. (2010). *Otoacoustic Emissions: Principles, Procedures, and Protocols* (1 edition). Plural Publishing Inc. 10. Rudolf Probst - A Review of otoacoustic emissions. JASA 89(5)	**Unit 3: Oto-acoustic emissions, evoked oto-acoustic emission** 1. Berlin, C.I. (Ed.) (1996). *Hair cells and hearing aids*. London: Singular Publishing Group. 2. Berlin, C. I., Hood, L. J., & Ricci, A. (2002). Hair Cell Micromechanics and Otoacoustic Emissions. New York: Thomson Learning Inc. 3. Hall, J. W. (2000). Handbook of Otoacoustic Emissions. San Diego: Singular Publishing Company. 4. Musiek, F. E., & Rintelmann, W. F. (1999). Contemporary Perspectives in Hearing Assessment. Boston: Allyn and Bacon. 5. Robinette, M. S., & Glattke, T. J. (2007). Otoacoustic Emissions: Clinical Applications (3rd Edn). New York: Thieme Medical Publishers,. 6. Roeser, R. J., Valente, M., and Dunn, H. H. (2007). Audiology: Diagnosis. New York: Thieme Medical Publishers. 7. Christopher, A. Shera (2004) Mechanism for mammalian OAE and their implication for the clinical utility of OAE. *Ear & Hearing*, Vol.25, No.2, 86-97. 8. Joint Committee on Infant Hearing. (2007). Year 2007 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs. *Pediatrics*, 120, 898-921. 9. **Hall, J. W., & Sumitrajit, D. (2010). *Otoacoustic Emissions: Principles, Procedures, and Protocols* (1st Edn). San Diego: Plural Publishing Inc.**

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	Unit 4 1. Shera & Guinan (1999) Evoked otoacoustic emissions arise by two fundamentally different mechanism: A taxonomy for mammalian cochlea JASA, 105 (2). 2. Sahley, T.L., Nodeer, R.H. and Musiek, F.E. (1997). *Efferent auditory system: Structure and function.* San Diego: Singular Publishing Group, Inc. 3. Kemp, D. T. (1978). Stimulated acoustic emissions from within the human auditory system. *Journal of Acoustical Society of America*, 64, 1386-1391. 4. Mills, D. M., & Rubel, E. W., (1994). Variation of distortion product otoacoustic emissions with furosemide injection, Hearing Research, 77, 183-199.	**Unit 4: Evoked oto-acustic emission** 1. Shera, C.A., & Guinan, J.J. Jr. (1999) Evoked otoacoustic emissions arise by two fundamentally different mechanism: A taxonomy for mammalian cochlea. *JASA*, 105 (2), 782-98. 2. Sahley, T.L., Nodeer, R.H., & Musiek, F.E. (1997). *Efferent auditory system: Structure and function.* San Diego: Singular Publishing Group Inc. 3. Kemp, D. T. (1978). Stimulated acoustic emissions from within the human auditory system. *Journal of Acoustical Society of America*, 64, 1386-1391. 4. Mills, D. M., & Rubel, E. W., (1994). Variation of distortion product otoacoustic emissions with furosemide injection, Hearing Research, 77, 183-199
	Common 1. Katz, J. (Ed.). (1994). *Handbook of Clinical Audiology*. Baltimore: Williams and Wilkins. 2. Hall, J.W. and Mueller, H.G. (1997) *Audiologists' Desk Reference* Volume 1: Diagnostic Audiology Principles, Procedures and Protocols. San Diego: Singular Publishing Group. 3. Rintleman, W.F. (1991). *Hearing Assessment*. Boston: Allyn and Bacon. 4. Roser, R.R., Valente, M & Hosford-Dunn, D (Eds) (2000*). Audiology: Diagnosis,* New York: Thieme Medical Publishers. **5.** Van De Water, T.R., Popper, A.N. and Fay, R.R. (Ed) (1996). *Clinical aspects of hearing.* New York: Springer	**Common** 1. Katz, J. (Ed.). (1994). *Handbook of Clinical Audiology*. Baltimore: Williams and Wilkins. 2. Hall, J.W., & Mueller, H.G. (1997) *Audiologists' Desk Reference* Volume 1: Diagnostic Audiology Principles, Procedures and Protocols. San Diego: Singular Publishing Group. 3. Rintleman, W.F. (1991). *Hearing Assessment*. Boston: Allyn and Bacon. 4. Roser, R.R., Valente, M., & Hosford-Dunn, D (Eds.) (2000*). Audiology: Diagnosis,* New York, Thieme. 5. Van De Water, T.R., Popper, A.N., & Fay, R.R. (Ed) (1996). *Clinical aspects of hearing.* New York: Springer

	Existing	*Proposed*
	88002 Auditory Physiology	**Auditory Physiology**
	Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Soft Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
1.	**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	**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

	hearing assessment 5. Applying the knowledge of auditory physiology to take appropriate clinical decisions	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 1: Conductive mechanism of auditory system 18 Hrs** 1.1 External Ear: Anatomy and physiology • Role of Pinna & External auditory meatus in hearing. • Resonance properties of external ear in humans. 1.2 Role of head in localization. **1.3 Role of skull in bone conduction** 1.4 Middle ear: Anatomy & Physiology of 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 2: Anatomy of the sensory auditory system 18 Hrs** 2.1 Macro & microanatomy **2.2 Cochlear fluids origin, composition, absorption, and dynamics** 2.3 Blood supply of inner ear 2.4 Innervations of inner ear 2.5 Cochlear regeneration 2.6 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	**Unit 3: Physiology of the sensory auditory system 18 Hrs** 3.1 Basilar membrane mechanics - historical and current status. 3.2 Cochlear transduction **and** electrophysiology 3.3 Cochlear potentials their generation and properties. 3.4 Cochlear non-linearity - two tone suppression, otoacoustic emission &

	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	other recent advances. 3.5 Nutrients related to sensory cell physiology 3.6 Physiology of auditory system in non mammalian species
	Unit 4: 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***	**Unit 4: Vestibular system 18 Hrs** **4.1 Anatomy and physiology of peripheral vestibular system** • **Semicircular canals** • **Utricle** • **Saccule** • **Vestibular nerve** **4.2 Anatomy of the central vestibular pathway and its connections** • **Brainstem** • **Cerebellum** • **Vestibular cortex** **4.3 Reflexes involving the vestibular system** • **Vestibulo-ocular reflex- pathways from each of the semicircular canals, cranial nerves involved (cranial nerves II, IV and V)** • **Vestibulospinal reflex** • **Sacculocollic reflex** **4.4 Other systems involved in balance** • **Proprioceptive (somatosensory) system- location of various receptors, strategies used for maintaining balance like ankle, hip, and step strategies** • **Visual system- Various kinds of eye movements like gaze, saccade, optokinetic and pursuit** **4.5 Association between vestibular system and cognition**
	PRACTICUM	
	Nil	1. Measure head related transfer function on 5 individuals 2. Measure the ear canal SPL and spectrum fro different azimuths of sound

		3. Measure non acoustic reflex on 5 individuals 4. Measure non linearity in auditory system using • Loudness growth function • OAEs
	REFERENCES	
	Existing	***Proposed***
	Unit 1 1. Beagly, H. A. (1981). Audiology & Audiological medicine. Oxford: Oxford university press. 2. Bekesy, G. V. (1960). Experiments in hearing. New York: Mc Graw Hill. ***3. De Reuck, A. V. S & Knight, J. (1968). Hearing mechanisms in vertebrates. London: Churchill.*** 4. ***Davis, D. V. (1969). Gray's anatomy: descriptive & applied. New Delhi: Orient Longmans***. *5.* Gelfand, S A. (2004). Hearing: Introduction to Psychological and Physiological Acoustics. (4th. edn.). New York, Marcel Decker 6. Guinan, J. J. & Peake, W. T. (1967). Middle ear characteristics of anesthetized cats. *Journal of Acoustical Society of America, 41, 1237-61.* 7. Gulick, W. L. & Others. (1989). Hearing: Physiology, acoustics, neural coding & psychoacoustics. New York: Oxford university press. 8. Jahn, A. F & Santos-Sacchi, J (1989). Physiology of the Ear. New York: Academic press. 9. Keidel, W. D. & Neff, W. D. (1974). Handbook of sensory physiology. Berlin: Springer. 10. Kiyofumi, G. I., Hiroshi, A., & Goode, R. L. (1987). Measurement of the ossicular vibration ratio in human temporal bone by use of a video measuring system. Acta Otolaryngologica, 103, 87-95. ***11. Moller, A. R. (1983). Auditory physiology. New York: Academic***	**Unit 1: Conductive mechanism of auditory system** 1. Beagly, H. A. (1981). Audiology & Audiological medicine. Oxford: Oxford University Press. 2. De Reuck, A. V. S. & Knight, J. (1968). Hearing mechanisms in vertebrates. London: Churchill. *3.* Gelfand, S. A. (2004). Hearing: Introduction to Psychological and Physiological Acoustics. (4th Edn.). New York: Marcel Decker. 4. Guinan, J. J., & Peake, W. T. (1967). Middle ear characteristics of anesthetized cats. *Journal of Acoustical Society of America, 41, 1237-61.* 5. Gulick, W. L., & Others. (1989). Hearing: Physiology, acoustics, neural coding & psychoacoustics. New York: Oxford University Press. 6. Jahn, A. F., & Santos-Sacchi, J. (1989). Physiology of the Ear. New York: Academic Press. 7. Keidel, W. D. & Neff, W. D. (1974). Handbook of Sensory Physiology. Berlin: Springer. 8. Kiyofumi, G. I., Hiroshi, A., & Goode, R. L. (1987). Measurement of the ossicular vibration ratio in human temporal bone by use of a video measuring system. *Acta Otolaryngologica*, 103, 87-95. 9. Moller, A. R. (2000). Hearing: Its physiology and pathology. San Diego: Academic Press. 10. Zemlin, W. R. (1998). Speech & Hearing science: Anatomy &

	press. 12. Moller, A. R. (2000). Hearing: Its physiology and pathology. San Diego: Academic press. ***13. Moore, B. C. J. (1995). Hearing. San Diego: Academic press.*** ***14. Popelka, G. R. (1981). Hearing assessment with acoustic reflex. New York: Grune & Stratton Press.*** ***15. Yost, S. A. (1994). Fundamental of hearing: An introduction. San Diego: Academic Press, Inc.*** 16. Zemlin, W. R. (1998). Speech & Hearing science: Anatomy & Physiology. Boston: Allyn & Bacon.	Physiology. Boston: Allyn & Bacon.
	Unit 2 1. Berlin, C. I (1996). Hair cells and hearing aids. San Diego: Singular publishing group. 2. Brown, R. D & Daigneault, E. A. (1981). Pharmacology of hearing. New York: Wiley. 3. Dallos, P. (1973). Auditory periphery: Biophysics & physiology. New York: Academic press. 4. Dallos, P., Popper, A. N. & Fry, R. R (1996). The cochlea. New York: Springer. ***5. Davis, D. V. (1969). Gray's anatomy: descriptive & applied. New Delhi: Orient Longmans.*** 6. De Reuck, A. V. S & Knight, J. (1968). Hearing mechanisms in vertebrates. London: Churchill. ***7. Moller, A. R. (1983). Auditory physiology. New York: Academic press.*** 8. Moller, A. R. (2000). Hearing: Its physiology and pathology. San Diego: Academic press. 9. Moore, B. C. J. (1995). Hearing. San Diego: Academic press. ***10. Yost, S. A. (1994). Fundamental of hearing: An introduction. San Diego: Academic Press, Inc.*** 11. Zemlin, W. R. (1998). Speech & Hearing science: Anatomy &	**Unit 2: Anatomy of the sensory auditory system** 1. Berlin, C. I. (1996). Hair cells and hearing aids. San Diego: Singular Publishing Group. 2. Brown, R. D., & Daigneault, E. A. (1981). Pharmacology of hearing. New York: John Wiley & Sons 3. Dallos, P. (1973). Auditory periphery: Biophysics & physiology. New York: Academic Press. 4. Dallos, P., Popper, A. N., & Fry, R. R. (1996). The cochlea. New York: Springer. 5. De Reuck, A. V. S., & Knight, J. (1968). Hearing mechanisms in vertebrates. London: Churchill. 6. Moller, A. R. (2000). Hearing: Its physiology and pathology. San Diego: Academic Press. 7. Moore, B. C. J. (1995). Hearing. San Diego: Academic Press. 8. Zemlin, W. R. (1998). Speech & Hearing Science: Anatomy & Physiology. Boston: Allyn & Bacon.

	Physiology. Boston: Allyn & Bacon.	
	Unit 3 1. Altschuler, R. A & Hoffman, D. W. (1986). Neurobiology of hearing: the cochlea. New York: Raven Press. 2. Berlin, C. I (1996). Hair cells and hearing aids. San Diego: Singular publishing group. 3. Brown, R. D & Daigneault, E. A. (1981). Pharmacology of hearing. New York: Wiley. 4. Dallos, P., Popper, A. N. & Fry, R. R (1996). The cochlea. New York: Springer. 5. Dong, W., & Olsen, E. S. (2008). Supporting evidence for reverse cochlear travelling waves. Journal of acoustic Society of America. 123, 222-240. 6. Drescher, D. G. (1985). Auditory biochemistry. Charles C. Thomas, Sringfield. 7. Flock, A., Ottoson, D., & Ulfendahi, M. (1995). Active hearing. Baltimore: Williams & Wilkins. *8.* Gelfand, S A. (2004). Hearing: Introduction to Psychological and Physiological Acoustics. (4th. edn.). New York, Marcel Decker 9. Gummer, A. W., Johnstone, B. M., & Armstrong, N. J. (1981). Direct measurement of basilar membrane stiffness in the guinea pig. *Journal of Acoustical Society of America*, 70, *1298-1309*. 10. Hudspeth, A. J. (1985). The cellular basis of hearing: the biophysics of hair cells. *Science*, 230, 745-752. 11. Jahn, A. F & Santos-Sacchi, J (1989). Physiology of the Ear. New York: Academic press. 12. Kemp, D. T. (1986). Otoacoustic emissions, travelling waves, and cochlear mechanisms. Hearing Research. 22, 95-104. ***13. Moller, A. R. (1983). Auditory physiology. New York: Academic press.***	**Unit 3: Physiology of the sensory and auditory system** 1. Altschuler, R. A., & Hoffman, D. W. (1986). Neurobiology of hearing: the cochlea. New York: Raven Press. 2. Berlin, C. I. (1996). Hair cells and hearing aids. San Diego: Singular Publishing Group. 3. Brown, R. D., & Daigneault, E. A. (1981). Pharmacology of hearing. New York: John Wiley & Sons. 4. Dallos, P., Popper, A. N., & Fry, R. R. (1996). The cochlea. New York: Springer-Verlag. 5. Dong, W., & Olsen, E. S. (2008). Supporting evidence for reverse cochlear travelling waves. *Journal of Acoustic Society of America*. 123, 222-240. 6. Drescher, D. G. (1985). Auditory biochemistry. Springfield: Charles C. Thomas. 7. Flock, A., Ottoson, D., & Ulfendahi, M. (1995). Active hearing. Baltimore: Williams & Wilkins. *8.* Gelfand, S. A. (2004). Hearing: Introduction to Psychological and Physiological Acoustics. (4^{th} Edn.). New York: Marcel Decker. 9. Gummer, A. W., Johnstone, B. M., & Armstrong, N. J. (1981). Direct measurement of basilar membrane stiffness in the guinea pig. *Journal of Acoustical Society of America*, 70, 1298-1309. 10. Hudspeth, A. J. (1985). The cellular basis of hearing: The biophysics of hair cells. *Science*, 230, 745-752. 11. Jahn, A. F., & Santos-Sacchi, J. (1989). Physiology of the Ear. New York: Academic Press. 12. Kemp, D. T. (1986). Otoacoustic emissions, travelling waves, and cochlear mechanisms. *Hearing*

	14. Moller, A. R. (2000). Hearing: Its physiology and pathology. San Diego: Academic press. 15. Rubels, L., & Ruggero, M. A. (2001). Mechanics of mammalian cochlea. Physiological Reviews. 81, 1305-52. 16. Robinette, M. S., & Glattke, T. J. (1997). Otoacoustic emissions: clinical applications. New York: Thieme. 17. Zemlin, W. R. (1998). Speech & Hearing science: Anatomy & Physiology. Boston: Allyn & Bacon.	*Research*. 22, 95-104. 13. Moller, A. R. (2000). Hearing: Its physiology and pathology. San Diego: Academic Press. 14. Rubels, L., & Ruggero, M. A. (2001). Mechanics of mammalian cochlea. Physiological Reviews. 81, 1305-52. 15. Robinette, M. S., & Glattke, T. J. (1997). Otoacoustic emissions: clinical applications. New York: Thieme Medical Publications. 16. Zemlin, W. R. (1998). Speech & Hearing Science: Anatomy & Physiology. Boston: Allyn & Bacon.
	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. *3.* Furman, J. M., & Cass, S. P. (2003). Vestibular disorders. Oxford University press. *4.* Gelfand, S. A. (2004). Hearing: Introduction to Psychological and Physiological Acoustics. (4th. edn.). New York, Marcel Decker 5. Highstein, S. M., Fay, R. R., & Popper, a. N. (2004). Vestibular system. 6. Jackler, R. K. & Brackmann, D. E. (2005). Neuro-otology. New York: Elsevier. 7. Jacobson, G. A., Newman, C. W., & Kartush, J. M. (1997). Handbook of balance function testing. 8. Nauton, R. F. (1975). The vestibular system. New York: Academic press. ***9. Waver, E. G. (1970). Theories of hearing. New York: Dover***. ***10. Zemlin, W. R. (1998). Speech & Hearing science: Anatomy & Physiology. Boston: Allyn & Bacon.***	**Unit 4: Vestibular system** 1. Bradford, L. J. (1975). Physiological measures of the audio-vestibular system. New York: Academic Press. *2.* Furman, J. M., & Cass, S. P. (2003). Vestibular disorders. Oxford: Oxford University Press. *3.* Gelfand, S. A., (2004). Hearing: Introduction to Psychological and Physiological Acoustics. (4th Edn.). New York: Marcel Decker. 4. Jackler, R. K., & Brackmann, D. E. (2005). Neuro-otology. New York: Elsevier Mosby. 5. Nauton, R. F. (1975). The vestibular system. New York: Academic Press.

Existing	*Proposed*
88005 Technology for Speech-Language & Hearing	**Technology for Speech-Language & Hearing**
Course: Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Soft Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
Objectives 1. To give an overview of the latest technology involved in speech Acoustics, Signal processing, Instrumentation etc. 2. To provide fundamental concepts of the technology used in the instruments for diagnostics and therapeutics in Speech Language Sciences and Pathology ***3. To learn the various signal processing strategies used in hearing aid amplification, noise reduction, channel based gain and output control.*** 4. To understand and observe the principle of working and functioning of equipments used for measurement of sounds and calibration of diagnostic equipments. 5. To learn practically the procedure for calibration of audiometers, middle ear analyzer, Otoacoustic emission analyzer, BERA etc.	**Objectives** **After successful completion of the course student should be able to:** 1. Give an overview of the latest technology involved in speech acoustics, signal processing and instrumentation. 2. Provide fundamental concepts of the technology used in the instruments for diagnostics and therapeutics in **Audiology**, Speech Language Sciences and Pathology 3. **Understand the basic technology used in hearing aids & cochlear implants**. 4. Understand the principle of working and utility of equipment used for measurement of sound and calibration of diagnostic equipment. 5. Perform calibration of diagnostic

6. To lay the foundation of ICT (Information and Communication Technology) concepts and illustrate the applications of ICT in Speech & Language Pathology 7. 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.	instruments. 6. Lay the foundation of Information and Communication Technology (ICT) concepts and illustrate its applications in ***Audiology***, Speech & Language Sciences & Pathology.
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 1: Transducers, signal processing components & power supply** **12 Hrs** 1.1 **Transducers used in speech, language and hearing** • Microphones: Basic structure & principle of operation of **dynamic, condenser and electret microphones.** • **Essential characteristics of microphones for recording, speech analysis and speech audiometry** • Loudspeakers: Basic structure & principle of operation of **dynamic loudspeaker, moving coil and balanced armature type receivers** • **Essential characteristics** of headphones and insert receivers **used in audiology** 1.2 Signal Processing components • Role of preamplifiers and power amplifiers • **Filters: Types and their role** 1.3 Power supply • **Requirements for mains supply to clinics** • **Internal power supply of instruments** • **Uninterrupted power supply for entire clinic vs. individual instruments**
Unit 2: Introduction to Digital signal processing and Information & Communication technology • ***Block diagram*** of a digital signal	**Unit 2:Introduction to digital signal processing and information & communication technology 12 Hrs** 2.1 Digital signal processing

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 tele-diagnosis & tele-rehabilitation system.	• Basic structure of a digital signal processing system • Process of analog to digital conversion • Process of digital to analog conversion • Basic concepts of digital signal processing: decomposition, processing and synthesis • Implementation of **signal processing functions** using DSP 2.2 Information technology • **Introduction to computer architecture** • **Role of operating systems** • **Role of RAM and hard disk** • **Structure and functioning of computer networks** 2.3 Communication technology • Frequency modulation & its applications in group hearing aids • Basic structure of a satellite communication system • **Concept of world wide web** • **Basic structure of internet connectivity** • Tele-diagnosis & tele-rehabilitation system.
Unit 3: Technology of hearing aids & cochlear implants, Speech processing and analysis • Block diagram of analog and digital hearing aids and their comparison. • Basic architecture of amplifiers in digital hearing aids] • Signal processing techniques in channel separation, non-linear amplification, output limiting, noise control, feedback cancellation etc. • Block diagram, structure, implementation, merits and demerits of group hearing aids and assistive listening devices. • Basic architecture of speech processor in cochlear implants, its principles of working and speech processing strategies. • ***Fundamentals of Mathlab based signal***	**Unit 3: Technology involved in hearing aids, cochlear implants and speech processing & analysis 15 Hrs** 3.1 Technology involved in hearing aids • Basic technology of a digital hearing aid • Technologies for non-linear amplification • Technologies for noise suppression • Technologies for feedback cancellation 3.2 Technology involved in cochlear implants • Basic architecture of a cochlear implant • Basic technology of speech processor 3.3 Fundamentals of speech signal processing • Representing a speech signal in time domain • Converting from time domain to

processing and its application in audiology. • Representation of a speech waveform in time and frequency domain • Short time analysis techniques • Techniques for estimating long term average spectrum • Applications of these techniques in - Speaker identification - Speaker verification - ***Speech recognition*** - Speech synthesis	frequency domain • Short time analysis techniques 3.4 Techniques of speech analysis & applications • **LPC analysis** • **Cepstrum analysis** • Speaker recognition • Speech synthesis • Speech to text conversion
Unit 4: Instrumentation in Audiology & Speech Language 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. • Procedure for noise auditing. • Room acoustics, factors to be considered	**Unit 4: Instrumentation in audiology, speech & language 15 Hrs** 4.1 Instrumentation in speech & language • Speech spectrograph and computerised analyses of speech • Voice analyses systems • Electroglotograph • Articulograph • Nasometer • Fibre optic endoscope 4.2 Instrumentation in audiology • Audiometer • Middle ear analyzer • Otoacoustic emission analyzer • Instrumentation for auditory evoked potentials • **Multichannel EEG and ERP systems** • Equipment and components used for measurement of sound and calibration 4.3 Room acoustics, measurements & electric grounding • Noise auditing • Measurement of reverberation time • Audiometric test room • **Recording room** • Procedure to make a perfect electric ground 4.4 Fundamentals of imaging technology • X-Ray • **C-Arm** • CT scan

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.	• MRI • fMRI • **PET** • **SPECT**
PRACTICUM	
Existing	***Proposed***
	1. Observe the operation of transducers. 2. Measure sound & noise 3. Calibration of audiometer/EGG 4. Measurement of reverberation time & ambient noise 5. Checking electrical grounding
REFERENCES	
Existing	***Proposed***
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, Kerlheinz. 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 and Sons. Crocker, Malcoem J.	**Unit 1: Transducers, signal processing components & power supply** 1. Crocker, M.J. (1998). *Handbook of Acoustics.* New York: John Wiley & Sons, Inc., 2. Rossing, T.D. (2002). *The Science of Sound. 3rd Edn.,* Glenview: Pearson Education, Inc., 3. Vonlanthen, A. (2007). *Hearing Instrument Technology for the Hearing Health Care Professionals*. London: Singular Publishing Group 4. Dillon, Harvey (2001). *Hearing Aids*. New York: Thieme Medical Publications. **5.** Katz, J. (2009). *Handbook of Clinical Audiology 6th Edn*. Philadelphia: Wolters Kluwer.
	Unit 2: Introduction to digital signal processing and information & communication technology 1. Nagpal, D. P. (2009). *Computer*

	Fundamentals: Concepts, Systems and Applications. New Delhi: S. Chand and Company. 2. Malvino, A. P. (1979). *Digital Computer Electronics.* Bombay: Tata McGraw Hill. 3. Kennedy, B. (1993). *Electronic Communiation Systems.4th Edn.* Bombay: Tata McGraw Hill. 4. Hersh, M. A., & Johnson, M.A. (2003). *Assistive Technology for the Hearing Impaired Deaf and Deaf-blind.* London: Springer 5. Tan, Li Jiang. (2013). *Digital Signal Processing: Fundamentals and Applications 2nd ed.* New York: Academic Press Inc
	Unit 3: Technology involved in hearing aids, cochlear implants and speech processing & analysis 1. Schaub, Arthur. (2008). *Digital Hearing Aids.* New York: Thieme Medical Publishers Inc. 2. Niparko, John K. (2009). *Cochlear implants - Principles and Practices* - 2nd Edn. New York: Lippincott Williams & Wilkins 3. Valente, Michael. (2002). *Hearing Aids: Standards, Options and Limitations*: Thieme Medical Publishers. 4. Sandlin, R.E. (2002). *Handbook of Hearing Aid Amplification, Vol. I: Theoretical and Technical Considerations,* London : Singular Publishing Group, Inc.
	Unit 4: Instrumentation in audiology, speech & language 1. Kent, R. D. (1995). *The Acoustic Analysis of Speech,* Delhi: AITBS Publishers, Inc. 2. Khandpur, R.S. (1993). *Hand Book of Bio-Medical Instrumentation*. Bombay: Tata Mcgraw Hill 3. Jacobson, John T. (1985). *Auditory Brainstem Response*. London: Taylor and Francis Ltd.

	4. Hall, James W. (2000). *Handbook of Otoacoustic Emissions*. New York : Delmar Cengage Learning. 5. Katz, J. (2009). *Handbook of Clinical Audiology. 6th Edn*. Philadelphia: Wolters Kluwer.

	Existing	*Proposed*
	Diseases of the Ear and Auditory Pathway	**Diseases of the Ear and Auditory Pathway**
	Course: Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100
	Objectives:	**Objectives: After successful completion of the course student will** **1. Understand clinical anatomy and physiology of the auditory system** **2. Obtain knowledge about the pathophysiology of diseases related to the ear.** **3. Have a holistic view about assessment and management of audio vestibular problems.**
	Unit 1 • Anatomy – of the external ear, mild ear and inner ear – labyrinth, cochlea, organ of corti, vascular supply of the (inner) ear, vestibule 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, demylenating disorders, cerebral cortex in hearing, central auditory pathway and its disorders, (to be dealt by Neurologist)/	**Unit 1: Anatomy and physiology of the auditory system 12 Hrs** **1.1** Anatomy: External ear, mild ear and inner ear (labyrinth, cochlea, organ of corti, vascular supply of the ear, vestibulocochlear nerve), central auditory pathways and its connection. **1.2** Structure and function of nervous system: Central and peripheral nervous system, synapse and chemical mediators, circle of willis, cerebral cortex in hearing, cranial nerves. **1.3** Neurophysiology: Action potential, summating potential, neuromuscular **junction, CSF,** central auditory pathway and its disorders
	Unit 2	**Unit 2: Diseases of the external and**

	• Diseases of the external ear, congenital malformations, injuries, Otitis – externa, Neoplasms of external ear, Was, 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, lipoid dystrotrophies, malignant granuloma, epidermoid turmors, reconstruction of middle ear hearing mechanisms. Diseases of the innder ear, congenital deafness, trauma, inflammatory conditions, meniers disease, presbyacusis, NIHL, sudeen SNHL, CP angle tumors, central deafness, reconstructive and rehabilitation procedures – BAHA and cochlear implants.	**middle ear** **18 Hrs** 2.1 Congenital malformations, 2.2 Diseases of the external ear: Otitis – externa, neoplasms of external ear, cerumen, keratosis obturans, injuries, sebaceous cysts, acquired atresia , stenosis of external auditory canal & malignant otitis externa 2.3 Diseases of the middle ear cleft: Otosclerosis otitis media, non suppurative otitis media, ,complications of middle ear diseases, neoplasms. 2.4 Diseases of the Otic capsule: Menieres disease, injuries, miscellaneous conditions of the otic capsule, CP angle tumor, trauma, inflammatory conditions, presbyacusis, NIHL, sudden SNHL central deafness, **2.5** Reconstruction of middle ear hearing mechanisms: Reconstructive and rehabilitation procedures
	Unit 3 • Ototoxicity – ototoxic and vestibulo – toxic drugs and its effects 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 3: Diseases of the cochlea** **12 Hrs** 3.1 Ototoxicity: Cochleotoxic and vestibule-toxic drugs and its effects, 3.2 Anatomical and physiological correlates in ototoxicity, epidemiology and mechanism 3.3 Systemic toxicity, topical toxicity, interventions, therapeutic uses of ototoxic drugs and pharmacology related to it 3.4 Medico-legal issues.
	Unit 4 • 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, Eapleys manoevour,	**Unit 4 Vestibular system** **12 Hrs** 4.1 Medical and surgical management of problems of ear causing communication disorders 4.2 Vestibular system: Medical, surgical, rehabilitative management

	vestibular rehabilitation exercises.	
	PRACTICUM	
	Existing	***Proposed***
		Observation of the following: ➢ ENT examination of • History taking • Diagnostic procedures • Microscopic examination & procedures • Otoscopy / Otoendoscopy • Equipments & instruments • Vertigo ➢ Various pathological conditions of the ear ➢ Surgical procedures in operation theatre Log book maintenance & submission
	REFERENCES	
	Existing	***Proposed***
		Unit 1: Anatomy and physiology of the auditory system **1. Gleeson, M. J., & Clarke, R. C. (2008). Scott-Brown's Otorhinolaryngology: Head and Neck Surgery 7th Ed: 3 volume set: CRC Press.** **2. Dhingra, P.L (2013 Diseases of Ear, Nose and Throat. New Delhi: Elseveir** **3. Blair, R and Maran A.D.G. (2001). Long Turners Diseases of Ear, Nose and Throat. Hodder Arnold** **4. English, G.M. (1976). Otorhino-laryngology a text book. Michigan: Medical Department Harper and Row** **5. Standring, S. (2008). Gray's Anatomy: The Anatomical Basis of Clinical Practice, Expert Consult. Livigstone: Churchill publishers.**
		Unit 2: Diseases of the external and middle ear **1. Gleeson, M. J., & Clarke, R. C. (2008). Scott-Brown's Otorhinolaryngology: Head and Neck Surgery 7th Ed: 3 volume set: CRC Press.** **2. Dhingra, P.L (2013 Diseases of Ear,**

		Nose and Throat. New Delhi: Elseveir **3. Blair, R and Maran A.D.G. (2001). Long Turners Diseases of Ear, Nose and Throat. Hodder Arnold** **4. English, G.M. (1976). Otorhino-laryngology a text book. Michigan: Medical Department Harper and Row** **5. Standring, S. (2008). Gray's Anatomy: The Anatomical Basis of Clinical Practice, Expert Consult. Livigstone: Churchill publishers.**
		Unit 3: Diseases of the cochlea **1. Gleeson, M. J., & Clarke, R. C. (2008). Scott-Brown's Otorhinolaryngology: Head and Neck Surgery 7th Ed: 3 volume set: CRC Press.** **2. Dhingra, P.L (2013 Diseases of Ear, Nose and Throat. New Delhi: Elseveir** **3. Blair, R and Maran A.D.G. (2001). Long Turners Diseases of Ear, Nose and Throat. Hodder Arnold** **4. English, G.M. (1976). Otorhino-laryngology a text book. Michigan: Medical Department Harper and Row** **5. Standring, S. (2008). Gray's Anatomy: The Anatomical Basis of Clinical Practice, Expert Consult. Livigstone: Churchill publishers.**
		Unit 4: Vestibular system **1. Weber, P.C. (2008). Vertigo and Disequilibrium: A Practical Guide to Diagnosis and Management. Thieme** **2. Biswas, A. (2005). Introduction to Neurotology. Mumbai: Bhalani Medical book house**

Existing	*Proposed*
Clinical Counselling	**Fundamentals of Clinical Counselling**
Course: Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100
Objectives 1. To prepare students in the specific area of clinical counselling **as a discipline seeking** to understand counsellor-client relationships in the context of training and rehabilitation of individuals with ***disorders in human communication***. 2. To train students into practical skills and competencies required for mastering basics of clinical counselling in their practice for identification and management of persons with communication disorders 3. To sensitize pupils on the ethical aspects of clinical counselling when dealing with individuals or their families with communication disorders. 4. To develop ability for integrating counselling based aspects in the field of research in communication disorders.	**Objectives** **After successful completion of the course student will be** **1.** Prepare in the specific area of clinical counselling to understand counsellor-client relationships in the context of training and rehabilitation of individuals with **communication disorders.** **2. Trained in practical skills and competencies required for mastering basics of clinical counselling for identification and management of persons with communication disorders.** 3. Sensitized on the ethical aspects of clinical counselling. 4. Able to integrating counselling based aspects in the field of research in communication disorders.
Unit 1 • Guidance and l Goals - Types and Techniques: Individual and Group • Special Focus on Clinical Counselling: Need and Applications • Counselling across Life Span: Child, Adolescent, Parenthood, Sibling, Grandparent/Elderly; Counselling across Relationships: Teacher, Family and Peer Group.	**Unit 1: Introduction 18 Hrs** 1.1 Guidance and Counselling: Meaning, Nature, Scope, Principles and Goals 1.2 Types and Techniques: Individual and group with special focus on need and applications of clinical counselling 1.3 Counselling across life span: Child, Adolescent, Parenthood, Sibling, Grandparent/Elderly; 1.4 Counselling across Relationships: Teacher, family and peer Group
Unit 2 • Portrait of Effective Counsellors –	**Unit 2: Counsellor qualities 18 Hrs** 2.1 Portrait of Effective Counsellors: Qualifications and Qualities, Micro and

Qualifications and Qualities – Micro and Macro Skills and Competencies – Do's and Don'ts; Expectations and Limitations in Professional Clinical Counselling – Tips for Improvement – Ethical Issues • ***Outline of Conditions requiring Clinical Counselling: 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***	macro skills and competencies 2.2 Do's and Don'ts; Expectations and Limitations in Professional Clinical Counselling 2.3 Tips for Improvement 2.4 Ethical Issues
Unit 3 • Counselling Process: Stages in Clinical Counselling – Preparation and Pre-requisites – Middle Phase – Termination – Therapeutic Relationships • Principles in Clinical Practice: Directive and Non-Directive • Approaches Tools for Clinical Counselling – Major Events (Transference, Counter Transference & Resistance)	**Unit 3: Counselling process 18 Hrs** 3.1 Counselling Process: Stages in Clinical Counselling 3.2 Preparation and Pre-requisites: Middle Phase, Termination 3.3 Therapeutic Relationships 3.4 Principles in Clinical Practice: Directive and Non-Directive approaches 3.5 Tools for Clinical Counselling 3.6 Major Events (Transference, Counter Transference & Resistance)
Unit 4 • Special Areas: ***Pre-marital, Marital, Vocational and Pre-vocational*** Clinical Counselling – Counselling the Differently Abled – Parent, Sibling and Grandparent Counselling – Crisis Counselling • Gender Counselling – Human Rights, Enablement and Empowerment through Counselling – Counselling the Elderly • Alternate/Holistic Forms of Counselling: Spiritual Counselling - Facilitation - Online Counselling - Contemplative Counselling – EMDR - Journal Therapy - Trauma Counselling - Emotional Freedom Technique - PSYCH-K Technique - Yoga & Meditation – Enneagram - Pastoral Counselling - Expressive Art Therapy - Gestalt Counselling - Massage Therapy – Scientific Basis, Cultural Constraints and	**Unit 4: Special areas 18 Hrs** 4.1Special Areas in clinical counselling: Counselling the differently abled, parents, sibling and grandparents and significant others 4.2 Counselling: Crisis counselling, gender counselling, human rights, 4.3 Enablement and empowerment through counselling 4.4 Counselling the elderly & psychiatric patients

Ethical Issues	
PRACTICUM	
Existing	***Proposed***
	1. Direct observation and thematic recording of at least two sessions of professional individual counselling. **2. Notes taking of group counselling session.** 3. **Eliciting counselling needs of target groups.**
REFERENCES	
Existing	***Proposed***
Tile: Clinical Counseling 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.	**Title: Fundamentals of Clinical Counselling** **Unit 1: Introduction** 1. Gelso, C.J., & Fretz, B.R. (1995). *Counselling Psychology*. New Delhi: A Prism Indian Edition. 2. Hansen, J.C., Stevic, R.R., & Warner, R.W. (1987). *Counselling*. Boston: Allyn & Bacon, Inc., 3. Nelson-Jones, R. (1999). *Introduction to Counselling Skills*. London: Sage Publications. 4. Rao, N.S. (1981). *Counselling Psychology*. New Delhi: Tata McGraw Hill Pub. Co. 5. Palmer, S., Dainow, S., & Milner, P. (1996). *Counselling*. London, Sage Pubs. 6. Shertzer, B.S., & Stone, B. (1968). *Fundamentals of Counselling*. NY: Houghton Mifflin Co. ***7. Neukrug, E. (2015). The world of counsellor: an introduction to counselling profession. Boston: Cengage Learning.*** ***8. Capuzzi, D., & Gross, D.R. (Eds.). (2013). Introduction to counselling program. New York: Routledge.***

Unit 2: 1. Street, E. (1994). *Counselling for Family Problems*. London, Sage Publications. 2. Blackham, G.J. (1977). Counselling – Theory, Process & Practice. Belmont: Wadsworth. 3. Palmer, S. (1999). *Introduction to Counselling and Psychotherapy*. London: Sage Publications. 4. Corey, G. (2011). Theory and practice of group counselling. 8th Edition. California: Brooks/Cole Publishing Company. 5. Corey, G. (2001a). *The art of integrative counselling.* Pacific Grove, CA: Brooks/Cole	**Unit 2**: **Counsellor qualities** 1. Street, E. (1994). *Counselling for Family Problems*. London, Sage Publications. 2. Blackham, G.J. (1977). Counselling – Theory, Process & Practice. Belmont: Wadsworth. 3. Palmer, S. (1999). *Introduction to Counselling and Psychotherapy*. London: Sage Publications. 4. Corey, G. (2011). Theory and practice of group counselling. 8th Edition. California: Brooks/Cole Publishing Company. 5. Corey, G. (2001). *The art of integrative counselling.* Pacific Grove, CA: Brooks/Cole. ***6. Gladding, S.T. (2009). Counselling: a comprehensive profession. New Delhi: Dorling Kindersley (India) Limited.*** ***7. Corey, G. (2013). Student manual for Corey's theory and practice of counselling and psychotherapy. Boston: Cengage Learning.***
Unit 3: 1. Nelson-Jones, R. (1982). *The Theory and Practice of Counselling Psychology*. London: Holt, Rinehart and Wilson. 2. Corey, G. (2008). Theory and practice of counselling and psychotherapy. California: Brooks/Cole. 3. Corey, G., Corey, C., and Corey, M.S. (2008). Groups: Process and Practice. California: Brooks/Cole. 4. Handbook of counselling psychology by Woolfe and Dryden, Sage, New Delhi, 1996. 5. Improving treatment compliance: counselling and systems strategies for substance abuse and dual disorders, by Dennis C.Daley.	**Unit 3: Counselling process** 1. Nelson-Jones, R. (1982). *The Theory and Practice of Counselling Psychology*. London: Holt, Rinehart and Wilson. 2. Corey, G. (2008). Theory and practice of counselling and psychotherapy. California: Brooks/Cole. 3. Corey, G., Corey, C., & Corey, M.S. (2008). Groups: Process and Practice. California: Brooks/Cole. ***4. Woolfe, R., Strawbridge, S., Douglas, B., & Dryden, W. (2010). Handbook of counselling psychology. New Delhi: Sage Publications.*** ***5. Daley, D.C., & Zuckoff, A. (1999). Improving treatment compliance: counselling and systems strategies for substance abuse and dual disorders. Minesota: Hazelden.*** ***6. Welfel, E.R. (2004). The counselling process: a multi-theoretical integrative***

	approach. Pacific Grove, CA: Thomas/Brooks/Cole. ***7. Bradly, L.J., & Ladany, N. (2001). Counsellor supervision: principles, process, and practice. Philadelphia: Brunner-Routledge.***
Unit 4: 1. Jacobs, Ed. E., Masson, R.L. & Harvill, R.L. (1998). *Group Counselling: Strategies & Skills*. Pacific grove, CA: Books/Cole Pub. Co., 2. Madden, G.R. (1998). *Legal Issues in Social Work: Counselling and Mental Health*. Thousand Oaks: Sage. 3. Thomas, R.M. (1990). *Counselling and Life-span development*. New Delhi: Sage. 4. Tudor, K. (1998). *Group Counselling*. London: Sage. 5. ***Group Counselling by George M.Gazda, Allyn & Bacon, Boston, 1989.*** 6. ***Intentional interviewing and counselling: facilitating client development in a multicultural society by Allen E.Ivey, Wadswoth Co. 1998***. 7. Hart, JT (1983). Modern eclectic therapy a functional orientation to counselling and psychotherapy. New York: Plenum.	**Unit 4: Special areas** 1. Jacobs, Ed. E., Masson, R.L., & Harvill, R.L. (1998). *Group Counselling: Strategies & Skills*. Pacific grove, CA: Books/Cole Pub. Co., 2. Madden, G.R. (1998). *Legal Issues in Social Work: Counselling and Mental Health*. Thousand Oaks: Sage. 3. Thomas, R.M. (1990). *Counselling and Life-span development*. New Delhi: Sage. 4. Tudor, K. (1998). *Group Counselling*. London: Sage. ***5. Hart, JT (1983). Modern eclectic therapy a functional orientation to counselling and psychotherapy. New York: Plenum.*** ***6. Maki, D.R., & Tarvydas, V.M. (2011). The professional practice of rehabilitation counselling. New York: Springer.*** ***7. Toporek, L., Gerstein, L., Fouad, N., Roysircar, G., & Isreal, T. (2006). Handbook of social justice in counselling psychology. New Delhi: Sage.*** ***8. Gazda, G.M. (1989). Group Counselling. Boston: Allyn & Bacon.*** ***9. Ivey, A.E. (1998). Intentional interviewing and counselling: facilitating client development in a multicultural society. New York: Wadsworth.***

II Semester		
	Existing	***Proposed***
	88022 Psychophysics of Audition	**Psychophysics of Audition**

	Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
	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.***	**Objectives** **After completion of the course, the student should be able to:** **1. Explain the basis of auditory object perception.** **2. Explain the influence of stimulus on auditory system with reference to adaptation and fatigue.** **3. Understand and describe different aspects of auditory space perception.** **4. Clinically implement the concept of binaural hearing in audiological assessment and management.**
	Unit 1 • **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 1: Auditory scene analysis 18 Hrs** **1.1 Auditory object perception in individuals with normal hearing and those with hearing impairment** • **Basic concepts in auditory object perception** • **Spectral cues for object perception** ○ **Spectral separation** ○ **Spectral profile analysis** • **Temporal cues for object perception** ○ **Temporal separation** ○ **Harmonicity/Temporal regularity** ○ **Temporal onset and offset** **1.2 Auditory pattern perception in individuals with normal hearing and those with hearing impairment** • **Timber perception** • **Time invariant-pattern and time varying pattern perception**
	Unit 2 • **Adaptation – (a) definition (b) adaptation vs fatigue (c) methods of studying adaptation (d) stimuliparameters affecting adaptation (e) neurophysiological**	**Unit 2:** Space perception **in individuals with normal hearing and those with hearing impairment 18 Hrs** **2.1 Localization of pure-tones** • **Cues for localization** • **Cone of confusion** • **Time-intensity trading**

	process in adaptation Space perception – (a) binaural hearing (b) localization vs lateralization (c) localization of puretones (d) cues for localization	**2.2 Localization of complex tones** • **Cues for localization** • **Acuity of lateralizing transients** • **Acuity as a function of frequency and use of envelope** • **Onset disparities vs. ongoing disparities** • **Time-intensity trading**
	Unit 3 • **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 3**: **Binaural hearing in individuals with normal hearing and those with hearing impairment 18 Hrs** **3.1 Models of binaural hearing in normal hearing individuals** **3.2 Binaural hearing** • **Binaural Squelch effect** • **Sluggishness of binaural system** • **Binaural fusion of pulsed stimuli** • **Binaural beats** • **Binaural interference** • **JND for dichotic phase** **3.3 Masking level difference** • **Pure tones** • **Complex signals**
	Unit 4 • 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**	**Unit 4: Auditory adaptation in individuals with normal hearing and those with hearing impairment 18 Hrs** **4.1 Adaptation vs. fatigue** **4.2 Methods of studying adaptation** **4.3 Binaural adaptation** **4.4 Neurophysiological basis of adaptation** **4.5 Factors affect adaptation** • **Subject** • **Stimulus** • **Procedural**
PRACTICUM		
	Existing	***Proposed***

	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***	Psychoacoustic Practicum • **Measuring binaural fusion for pulsed stimuli on 3 individuals with normal hearing.** • **Measuring JND for dichotic phase on 3 individuals with normal hearing.** • **Measuring masking level difference for pure-tone and complex signals on 3 individuals each with normal hearing**
REFERENCES		
	Existing	***Proposed***
	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 3nd 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	**Unit 1: Auditory scene analysis** 1. Bregman, A. S. (1994). Auditory Scene Analysis. The Perceptual Organization of Sound: MIT Press. 2. Gelfand, S.A. (2004). Hearing. An introduction to psychological and physiological acoustics. 4th Edn. New York: Marcel Dekker. 3. Moore, B. C. J. (1995). Hearing, San Diego: Academic Press. 4. Moore, B. C. J. (1997). Introduction to psychology of hearing. San Diego: Academic Press. 5. Moore, B. C. J. (2008). Cochlear hearing loss: physiological, psycho-logical and technical issues. 2nd Ed. Wiley-Blackwell. 6. Pillow, J. (2009). Hearing in the Environment: Perception (PSY 323). Austin: The University of Texas. 7. Warren, R. M. (2008). Auditory Perception: An Analysis and Synthesis. Cambridge: Cambridge University Press. 8. Yost, W. A. (1994). Fundamentals of hearing (all editions). CA: Academic Press Inc.
		Unit 2: Space perception in individuals

	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.	**with normal hearing and those with hearing impairment** 1. Gelfand, S, A. (2005). Introduction to psychological and physiological acoustics. NY: Marcel Dekker. 2. Gullick, W. L., Gescheider, G. A., & Frisina, R. D. (1989). Hearing: Physiology Acoustics, Neural Coding & Psychoacoustics. OUP USA. 3. Moore, B. C. J. (1995). Hearing. San Diego: Academic Press. 4. Moore, B. C. J. (1997). Introduction to psychology of hearing, San Diego: Academic Press. 5. Pickles, J.O. (2008). Introduction to Physiology of Hearing. New York: Academic Press. 6. Tobias, V. J. (1970). Foundation of Modern Auditory Theory, San Francisco: Academic Press. 7. Warren, R. M. (2008). Auditory Perception: An Analysis and Synthesis. Cambridge: Cambridge University Press. 8. Yost, W. A. (1994). Fundamentals of hearing: An introduction. San Diego, Academic Press. 9. Yost, W. A., & Gourevitch, G. (1987). Directional Hearing, New York: Springer-Verlag.
	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). 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	**Unit 3: Binaural hearing in individuals with normal hearing and those with hearing impairment** 1. Gelfand, S.A. (2004). Hearing. An introduction to psychological and physiological acoustics. 4th Edn. New York: Marcel Dekker. 2. Jerger, J. (1973). Modern developments in Audiology. 2nd Edn. New York. Academic Press. 3. Loven, F. (2009). Introduction to normal auditory perception. Singapore: Delmar Cengage Learning. 4. Rosen, S., & Howell, D. (1991). Signals and systems for speech and hearing. CA: Academic Press Inc. 5. Tobias, J. V. (1970). Foundation of

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

	Existing	***Proposed***
	88023 Electrophysiological Assessment of the Auditory System	**Electrophysiological Assessment of the Auditory System**
	Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
	Objectives After completion of this course, candidate should be able to 1. List different auditory evoked potentials (AEPs) 2. Describe general principles in	**Objectives** After completion of this course, students should be able to 1. Describe different auditory evoked potentials (AEPs), **their clinical applications** and generators **sites.**

	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***	2. Describe general principles in recording various AEPs 3. Independently decide the need for recording a particular AEP in a clinical set-up. 4. Independently set the parameters for recording and analyzing various AEPs.
	a) *Classification and generators of auditory evoked potentials* I. • Exogenous potentials such as Ecochg, ABR, MLR, LLR II. • Endogenous potentials such as P300, MMN, CNV III. • Steady state evoked potential b) *General principle in recording of auditory evoked potentials* I. • Exogenous potentials such as Ecochg, ABR, MLR, LLR II. • Endogenous potentials such as P_{300}, MMN, CNV III. • Steady state evoked potential *c) Implications in differential diagnosis and management, research needs*	**Unit 1: General principle in recording of AEPs 18 Hrs** **1.1 Stimuli for recording AEPs.** **1.2 Acquisition of EEG signal** • **Common mode rejection** • **A/D conversion** • **Amplification** • **Antialasing filter** • **Dipole orientation and scalp distribution** **1.3 Signal processing techniques** • **Analog filters & digital filters** • **Time locked acquisition** • **Amplitude based techniques for artifact rejection** • **Unweighted and weighted time domain averaging** • **Unweighted and weighted frequency domain averaging** 1.4 Rationale for nomenclature and generators of auditory evoked potentials
	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 2 Early potentials 18 Hrs** **2.1 Electro-cochleograhy:** Acquisition, analysis and application of • Cochlear microphonics • Summating potentials • Action potentials 2.2 **Auditory Brainstem Responses:** Acquisition, analysis and application of • Frequency specific ABRs using tone burst, chirp and masking methods • Complex ABRs

		• **Stacked ABR**
	I. a) Factors affecting recording and interpretation of middle latency response • Subject variables • Stimulus variables • Recording variables i. 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 3 Middle and late AEPs 18 Hrs** 3.1 Factors affecting MLR **&** LLR • Stimulus • Acquisition • Subject 3.2 Clinical application of MLR and LLR 3.3 **Acoustic change complex:** Acquisition, analysis and application 3.4 **Frequency following responses:** Acquisition, analysis and application 3.5 **Auditory steady state responses:** Acquisition, analysis and application 3.6 **VEMP & PAM :** Acquisition, analysis and application
	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	**Unit 4 Endogenous potentials 18 Hrs** **4.1 Overview of endogenous potentials** **4.2 Acquisition, analysis,** factors affecting **and application of** • MMN • P_{300} • N_{400} • P_{600} • ELAN • CNV • Other endogenous potentials **4.3 Multi-modality stimulation** **4.4 Special techniques involved in acquisition and analysis of**

		endogenous potentials
	PRACTICUM	
		1. Calibrating the transient stimuli used for ABR using objective and , MLR and LLR using objective and subjective methods 2. Recording Auditory Brainstem Responses to click, tone burst, chirp and speech stimuli and observing the effect of stimulus and acquisition parameters on the latency, amplitude and morphology of the responses. 3. Practicing diagnostic tests using Auditory brainstem responses, like hearing threshold estimation, site-of-lesion testing, cochlear hydrops analysis masking procedure and stacked ABR. 4. Recording the Auditory Middle latency responses and long latency responses to click, tone burst and speech stimuli, and observing the effects of stimulus and acquisition parameters on the latency, amplitude and morphology of the responses. 5. Recording the P300 and mismatch negativity to frequency, intensity and duration deviance in pure tones, and place manner and voicing contrasts in consonant (stop) vowel combinations. 6. Estimating hearing threshold using ABR, MLR and LLR on 5 children with normal hearing, 5 children with hearing loss, 5 adults with normal and 5 adults with hearing loss.
	REFERENCES	
	Existing	***Proposed***
	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.	**Unit 1: General principle in recording of AEPs** 1. Burkard, R.F., Don, M., & Eggermont, J.J. (Eds.) (2007). Auditory Evoked Potentials: Basic Principles & Applications. Baltimore: Lippincott Williams & Wilkins. 2. Ferraro, J.A. (1997). Laboratory exercises in auditory evoked potentials. San Diego: Singular Publishing Group

	3. Hall, J.W. (1992). Handbook of Auditory Evoked Responses. Massachussetts: Allyn and Bacon. 4. Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson ***5. Hall, J.W. & 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 Francies.*** ***8. Jacobson, J.T. (Ed). (1994). Auditory Brainstem Response. London: Taylor and Francies.*** ***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.*** ***11. Rance, G. (E.d) (2008). The Auditory Steady-State Response: Generation, Recording, and Clinical Application, San Diego: Plural Publishing.*** 12. Roser, R.R., Valente, M., & Hosford-Dunn, D. (Eds) (2000). Audiology: Diagnosis. New York: Thieme.	Inc. **3. Picton, T. (2010). Human Auditory Evoked Potentials. San Diego: Plural Publishing.** 4. Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson. 5. Katz, J. (Ed.). (1994). Handbook of Clinical Audiology. Baltimore: Williams and Wilkins. 6. Roser, R.R., Valente, M., & Hosford-Dunn, D. (Eds.) (2000). Audiology: Diagnosis. New York: Thieme Medical Publishers.
	Unit 2: 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	**Unit 2:Early potentials** 1. Burkard, R.F., Don, M., & Eggermont, J.J. (Eds.) (2007). Auditory Evoked Potentials: Basic Principles & Applications. Baltimore: Lippincott Williams & Wilkins. 2. Hall, J.W. (1992). Handbook of Auditory Evoked Responses. Massachussetts: Allyn and Bacon. 3. Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson 4. Hall, J.W., & Mueller, H.G. (1997)

	1: Diagnostic Audiology Principles, Procedures and Protocols. San Diego: Singular Publishing Group. 5. Hood, L.J. (1998). Clinical applications of auditory brainstem response. San Diego: Singular Publishing Group Inc. 6. Roser, R.R., Valente, M., & Hosford-Dunn, D. (Eds) (2000). Audiology: Diagnosis. New York: Thieme.	Audiologists' Desk Reference. Volume 1: Diagnostic Audiology Principles, Procedures and Protocols. San Diego: Singular Publishing Group. 5. Hood, L.J. (1998). Clinical applications of auditory brainstem response. San Diego: Singular Publishing Group Inc. 6. Roser, R.R., Valente, M., & Hosford-Dunn, D. (Eds.) (2000). Audiology: Diagnosis. New York: Thieme Medical Publishers. 7. Sininger, Y., & Starr, A. (2001). A**uditory neuropathy: A new perspective on hearing disorders. Singular Publications.** 8. **Picton, T. (2010). Human Auditory Evoked Potentials. San Diego: Plural Publishing Group.**
	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 3: Middle and late AEPs** 1. Burkard, R.F., Don, M., & Eggermont, J.J. (Eds.) (2007). Auditory Evoked Potentials: Basic Principles & Applications. Baltimore: Lippincott Williams & Wilkins. 2. Hall, J.W. (1992). Handbook of Auditory Evoked Responses. 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 Medical Publishers. 7. McPherson, L.D. (1995). Late potentials of the auditory system. London: Singular Publishing Group. 8. Picton, T. (2010). Human Auditory Evoked Potentials. San Diego: Plural Publishing Group.
	Unit 4: 1. Burkard, R.F., Don, M., & Eggermont, J.J. (Eds.) (2007). Auditory Evoked Potentials: Basic Principles &	**Unit 4: Endogenous potentials** 7. 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. Jacobson, J.T. (Ed). (1985). Auditory Brainstem Response. London: Taylor and Francies. 5. Jacobson, J.T. (Ed.). (1994). Auditory Brainstem Response. London: Taylor and Francies. 6. Katz, J. (Ed.). (1994). Handbook of Clinical Audiology. Baltimore: Williams and Wilkins. 7. McPherson, L.D. (1995). Late potentials of the auditory system. London: Singular Publishing Group. 8. Rance, G. (Ed.) (2008). The Auditory Steady-State Response: Generation, Recording, and Clinical Application. San Diego: Plural Publishing. 9. Roser, R.R., Valente, M. & Hosford-Dunn, D. (Eds.) (2000). Audiology: Diagnosis. New York: Thieme.	Applications. Baltimore: Lippincott Williams & Wilkins. 8. Hall, J.W. (1992). Handbook of Auditory Evoked Responses. Massachussetts: Allyn and Bacon. 9. Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson. 10. Katz, J. (Ed.). (1994). Handbook of Clinical Audiology. Baltimore: Williams and Wilkins. 11. McPherson, L.D. (1995). Late potentials of the auditory system. London: Singular Publishing Group. 12. Roser, R.R., Valente, M., & Hosford-Dunn, D. (Eds.) (2000). Audiology: Diagnosis. New York: Thieme Medical Publishers. 13. Picton, T. (2010). Human Auditory Evoked Potentials. San Diego: Plural Publishing Group.

	Existing	***Proposed***
	88021 Neurophysiology of Hearing	**Neurophysiology of Hearing**
	Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Soft Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
	Objectives	**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***	After going through this **course**, the student shall be able to describe: **1. The different parts of auditory afferent and efferent systems** **2. The functioning of auditory afferent and efferent systems** **3.** The methods used in auditory neurophysiology **4.** Physiological basis of electrophysiological tests used for hearing assessment **5. The neurophysiological basis of clinical interpretation**
	Unit 1: Anatomy & physiology of the auditory nerve & 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 1: Anatomy & physiology of the auditory nerve 18 Hrs** 1.1 Structure and tonotopic organization of auditory nerve 1.2 Electrophysiology - Action potential, generation and properties. 1.3 **Physiology of the auditory nerve** • Stimulus coding - frequency, intensity and temporal coding. • **Coding of complex signal at the auditory nerve** • Non-linearity seen at auditory nerve. **1.4 Synapse** • Neuro-transmitters vs. neuro-modulator • Properties and function of neuro-transmitter • Afferent and efferent neuro-transmitters **1.5 Application of knowledge of auditory nerve physiology in understanding various auditory nerve disorders**
	Unit 2: Central auditory pathway *Anatomy of the ascending auditory pathway* 1 Cochlear nucleus	**Unit 2: Central auditory pathway 18 Hrs** 2.1 Anatomy of the ascending auditory

	2 Superior olivery complex
	3 Lateral leminiscus
	4 Inferior colliculus
	5 Medial geniculate body
	6 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***
		pathway
		• Cochlear nucleus
		• Superior olivary complex
		• Lateral leminiscus
		• Inferior colliculus
		• Medial geniculate body
		• Tonotopic organization at the different levels.
		
		2.2 Physiology of the ascending auditory pathway
		• **Physiology of the cochlear nucleus**
		• **Physiology of superior olivary complex**
		• **Physiology of lateral leminiscus**
		• **Physiology of inferior colliculus**
		• **Physiology of medial geniculate body**
		• **Coding of simple and complex acoustic signal at various sub cortical levels**

	Unit 3: Auditory Cortex:
	
	• 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 3: Auditory cortex 18 Hrs
		
		3.1 Anatomy and tonotopic organization of the primary and secondary auditory area.
		
		3.2 Classifications of the auditory cortex
		
		3.3 Neurobiological relationship between auditory cortex and other areas
		
		3.4 Neurophysiology of the auditory area.
		  • Coding of the stimulus parameters.
		  • Coding of the complex acoustic signal
		  • Plasticity of the auditory **system**
		
		3.5 Coding of speech in auditory system
		
		3.6 **Physiology of sound localization in the auditory system**

	Unit 4: Anatomy & physiology of the efferent pathway & cranial nerves related to ear
	
	4 Anatomy of the efferent auditory system
	  • Courses and distribution of MSOC in the cochlea
		Unit 4: Anatomy & physiology of the efferent pathway & cranial nerves related to ear 18 Hrs
		
		4.1 Anatomy of the efferent auditory system
		  • Courses and distribution of MSOC

	• 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. 5 Perception of auditory stimulus. 6 Protective function. **7** Anatomy of the cranial nerves related to ear.	in the cochlea • Courses and distribution of LSOC in the cochlea • Anatomy of the thalamic & upper brainstem efferent auditory system **4.2 Physiology of the auditory efferent system** • **Effect of auditory efferent system on physiology of cochlear nucleus, auditory nerve and cochlea** • **Role of auditory efferent system in perception of auditory stimuli.** • Protective function **of auditory efferent system** **4.3 Anatomy of non-classical auditory pathway** 4.4 Anatomy of the **other** cranial nerves related to ear.
	PRACTICUM	
		Observe specimens of various auditory structures and make notes of observations
	REFERENCES	
	Existing	***Proposed***
	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	**Unit 1: Anatomy & physiology of the auditory nerve** 1. Musiek, F.E., & Baran, J.A. (2006). The auditory system: anatomy, physiology and clinical correlates. USA: Indiana University Press. 2. Jahn, A.F., & Santos-Sacchi, J. (2001). Physiology of the ear. San Diego: Singular/Thomson Learning. 3. Gelfand, S.A. (2004). Hearing: An introduction to psychological and physiological acoustics. USA: Marcel Dekker Inc. 4. Webster, D.B., Popper A.N., & Fay R.R. (1992). The Mammalian auditory pathway: neuroanatomy. New York: Springer-Verlag. 5. Webster, D.B., Popper, A.N., & Fay R.R. (1992). The Mammalian auditory pathway: neurophysiology. New York:

	University Press. 8. Neurobilogy 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	Springer Link. 6. Pickels, J.O. (2012). An introduction to the physiology of hearing. United Kingdom: Emerald Group Publishing Inc. 7. Günter, E., & Romand, R. (1997). The central auditory system. United Kingdom: Oxford University Press. 8. Richard, A. (1991). Neurobiology of Hearing. USA: Raven Press. 9. Enrique A. & Lopez-Poveda,S. (2010). The neurophysiological bases of auditory perception. New York: Springer -Verlag. 10. Rees, A., & Palmer, A.R. (2010). The Oxford Handbook of Auditory science: The auditory brain. United Kingdom: Oxford University Press. 11. Moore, D., Palmer, A., & Fuchs, P. (2010). Oxford handbook of auditory science the ear. United Kingdom: Oxford University Press. **12. Schnupp, J., Nelken, I., & Andrew, K (2011). Auditory Neuroscience: Making Sense of Sound. USA: Library of Congress.** **13. Musiek, F.E., Baran, J.A., Shinn, J., & Raleigh, J. (2012). Disorders of the Auditory System. San Diego: Plural Publishers.** **14. Günter, E., & Romand, R. (1997). The central auditory system. United Kingdom: Oxford University Press.**
	Unit 2 *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*	**Unit 2: Central auditory pathway** 1. Douglas, B., Webster, N., Arthur N. & Richard R. (1992). The Mammalian auditory pathway: neuroanatomy. New York: Springer -Verlag. 2. Douglas, B. Webster, N., Arthur N. & Richard R. (1992). The Mammalian auditory pathway: neurophysiology. New York: Springer Link. 3. Anthony, F. J., & Santos-Sacchi, J. (2001). Physiology of the ear. San Diego: Singular/Thomson Learning. 4. Jeffery, A., & Schreiner, C. (2005).

	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. *Neurobilogy 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.*	The inferior Colliculus. USA: Springer-Verlag. 5. Lambert, M.S., Miriam T. T, & Susan F. M (2010). Superior Olivary Complex. USA: Betascript Publishers. 6. Steven, G., & William, A.A. (2006). Listening to Speech: auditory perspectives. New Jersey: Lawrence Erlbaum Associates Inc. 7. Greenberg, S. (2004). Speech processing in the auditory system. USA: Springer-Verlag. 8. Enrique, A., & Lopez-Poveda (2010). The Neurophysiological Bases of Auditory Perception. USA: Springer-Verlag 9. Richard, A. (1991). Neurobiology of Hearing. USA: Raven Press. 10. Enrique, A., & Lopez-Poveda (2010). The Neurophysiological Bases of Auditory Perception. USA: Springer-Verlag 11. Adrian, R., & Alan. R. P. (2010). The Oxford Handbook of Auditory Science: The Auditory Brain. United Kingdom: Oxford University Press. 12. Moore, D., Alan, P., & Fuchs, P. (2010). Oxford handbook of auditory science the ear. United Kingdom: Oxford University Press. 13. Syka, J. (1996). Acoustical signal processing in the central auditory system.USA: Springer-Verlag. **14. Tremblay, K., & Robert F. B. (2013). Translational Perspectives in Auditory Neuroscience. San Diego: Plural Publications.**
	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.*	**Unit 3: Auditory cortex 18 Hrs** 1. Reinhard., K. (2005). The auditory cortex: a synthesis of human and animal research. New Jersy: Routledge Publishers. 2. Jasper, R., & Devon, I.R. (2009). Clinical neurophysiology. United Kingdom: 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*	3. Greenberg, S., & William A. A. (2006). Listening to Speech: auditory perspectives. New Jersey: Lawrence Erlbaum Associates Inc. 4. Greenberg, S. (2004). Speech processing in the auditory system. USA: Springer-Verlag. 5. Enrique, A., & Lopez-Poveda (2010). The Neurophysiological Bases of Auditory Perception. USA: Springer-Verlag. 6. Douglas, B, W., Popper, A.N., & Fay, R.R. (1992). The Mammalian auditory pathway: neuroanatomy. New York: Springer-Verlag. 7. Jahn, A.F., & Santos-Sacchi J. (2001). Physiology of the ear. San Diego: Singular/Thomson Learning. 8. Enrique, A., & Lopez-Poveda (2010). The Neurophysiological Bases of Auditory Perception. USA: Springer-Verlag. 9. Aitkin, L. (1990). The auditory cortex: structural and functional bases of auditory perception. University of Michigen: Chapman and Hall. 10. Syka, J., & Merzenich, M.M. (2003). Plasticity and signal representation in the auditory system. USA: Springer Science. 11. Meddis, R.(2010). Computational Models of the Auditory System. USA: Springer-Verlag. 12. Syka, J. (1997). Acoustical signal processing in the central auditory system. USA: Springer Science.
	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.	**Unit 4: Anatomy & physiology of the efferent pathway and cranial nerves related to ear** 1. Lambert, M., Surhone, M.T., & Susan, F. M. (2010). Superior Olivary Complex. USA: Betascript Publishers. 2. Douglas, B.W., Arthur, N. P., & Fay, R.R. (1992).The Mammalian auditory pathway: neuroanatomy. New York: Springer-Verlag.

	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	3. Douglas, B. W., Arthur, N. P., & Richard, R.F. (1992). The Mammalian auditory pathway: neurophysiology. New York: Springer-Verlag. 4. Anthony, F. J., & Santos-Sacchi, J. (2001). Physiology of the ear. San Diego: Singular/Thomson Learning. 5. Berlin, C.E. (1999). The efferent auditory system: basic science and clinical applications. USA: Singular Publishing Group. 6. Tony, L. S., Richard, H. N., & Musiek, F.E. (1997). Efferent auditory system: structure and function. USA: Singular Publishing Group. 7. Ryugo, D.K. (2010). Auditory and Vestibular Efferents. USA: Springer-Verlag. 8. Syka, J. (1997). Acoustical signal processing in the central auditory system. USA: Springer Science.

Existing	***Proposed***
Speech Production	**Speech Production**
Course: Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Soft Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
Objectives ***1. After going through this course the student will be able to explain or understand*** ***2. Physiology and Theories of Speech Production,*** ***3. Acoustic characteristics and Acoustic analysis of Speech*** ***4. Spectrography and its clinical applications*** ***5. Instrumentation in speech production and speech acoustics***	**Objectives** **1. After completing this course, the student shall be able to:** **2. Describe the Physiology of Speech Production** **3. Discuss the Acoustic Theories** **4. Describe the Acoustic Characteristics of Various Speech Sounds** 5. **Know the Application of Acoustic Analysis and Speech Synthesis**
Unit 1 ***Introduction to the study of speech***	**Unit 1:** Introduction to the study of speech **physiology** **18 Hrs**

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

frication and aspiration, voice onset time, formant transitions, voicing characteristics. ***Acoustic Characteristics of nasal consonants: Vowel 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 2: Theories and instrumentation in speech production 18 Hrs** **2.1 Acoustic theory of speech production**: • **Source, types and its characteristics** • **Filter / transfer function and its characteristics** • **Output speech and its characteristics** • **Cavity volume and resonance relationship** • **Critical evaluation of acoustic theory of speech production** **2.2 Fundamental aspects of speech acoustics** • **Acoustic wave** • **Analog and digital signal** • **Digitization** • **Analog-to-digital conversion**

	• **Sampling** • **Quantization** • **Bandwidth** • **Frequency resolution** • **Window** • **Block duration** • **Pre-emphasis** • **Filtering** • **Block shift** **2.3 Acoustic analysis of speech** • **Digital signal processing [waveform analysis, fast fourier transformation (FFT) and linear prediction correlation (LPC), pitch extraction, auto correlation, digital spectrogram, inverse filtering, long term average spectrum (LTAS), cepstrum]** **2.4 Data acquisition systems- acoustic analysis softwares** • **Format analysis** • **Formant tracking** • **F0 and intensity analysis** • **Computerized Speech Lab (CSL)** • **PRAAT**
Unit 3 ***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, f0, shift, voicing, melody types, continuity, glottal plosives, nasality, tension, subhormonic break / double harmonic break/ latency, second pause, biphonation / diplophonation, furcation, noise concentration, tonal pit.*** ***Acoustics of normal and abnormal cries – Weight, oropharyngeal abnormalities,***	**Unit 3: Acoustic characteristics of speech sounds and spectrography 18 Hrs** **3.1 Spectrogram** • **Spectrograms of vowels and consonants** • **Identifying place of articulation, manner of articulation, voicing and aspiration** • **Identification of vowels, syllables, words, word boundaries and sentences** **3.2 Acoustic characteristics of vowels and diphthongs** • **Vowel classification** • **Vowel formant pattern** • **Vowel short-term spectrum** • **Vowel duration** • **Vowel fundamental frequency** • **Formant bandwidth and amplitude on glide and off glide of formants** **3.3 Acoustic characteristics of plosives** • **Vocal tract configuration**

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, Gullets model, Lester's model, Model of Porgies & Maita, Two-part biobehavioual model*** ***Future directions in infant cry analysis*** ***Acoustic analysis of laughter – Why acoustic analysis? Types of laughter, acoustic characteristics of laughter.***	• **Five distinct characteristics of Plosives** • **Closure duration** • **Release burst** • **Release burst spectrum** • **Release burst amplitude** • **Friction and aspiration** • **Voice onset time** • **Formant transitions** • **Voicing characteristics** **3.4 Acoustic characteristics of nasal consonants** • **Vowel tract configuration** • **Formant frequencies** • **Nasal murmur** • **Formant damping** • **Bandwidth** • **Formant transitions** • **Antiformants** **3.5 Acoustic characteristics of fricatives** • **Vocal tract configuration** • **Classification of fricatives** • **Acoustic characteristics of stridents and non-stridents** **3.6 Acoustic characteristics of other consonants** • **Affricates: Vocal tract configuration, acoustic differences between affricates and plosives** • **Glides: Vocal tract configuration, formants, and transitions** • **Liquids: Vocal tract configuration, formants, anti formants and transitions.**
Unit 4 ***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.***	**Unit 4: Application of acoustic analysis and speech synthesis 18 Hrs** **4.1 Applications of acoustic analysis in speech disorders: speech of persons with hearing impairment, stuttering, dysarthria, cleft lip and palate** **4.4 Speech Synthesis:** • **Types: Articulatory synthesis, parametric synthesis and analysis by**

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, conversional 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*	**synthesis** • **Applications of speech synthesis**
PRACTICUM	
	• **Measurement of aerodynamic parameters using spirometer and aeroview** • **Practical on fft, lpc, cepstrum and inverse filtering** • **Acoustic analysis of vowels, diphthongs, plosives, nasals, fricatives, affricates and other speech sounds using spectrograms on praat** • **Vowel synthesis using parametric and analysis by synthesis** • **Demonstration of articulatory synthesis**
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	Proposed
	Age Related Changes in Audio-Vestibular System
	Course: Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100
Objectives:	**Objectives:** **After successful completion of this course, the student should be able to:** **1. Explain the age-related changes in peripheral, central auditory and vestibular systems** **2. Modify tests and interpret their outcomes taking into account an individual's age**
Unit 1:	**Unit 1: Anatomical and physiological changes in the audio-vestibular system from embryonic stages onwards. 18 Hrs** 1.1 Conductive mechanism • External ear (pinna, external auditory meatus and tympanic membrane) • Middle ear 1.2 Cochlea • Hair cells • Stria vascularis • Basilar membrane properties • Transduction properties • Other structures 1.3 Peripheral vestibular system • Semi-circular canals • Otolith organs (Utricle & Saccule 1.4 Age at which maturation is attained and age at which decline commences for: • Conductive mechanism • Cochlea • Peripheral vestibular system
Unit 2:	**Unit 2: Anatomical and physiological changes in audio-vestibular nervous system from embryonic stages onwards. 18 Hrs** 2.1 Auditory nervous system • Auditory nerve

	• Other structures suchas cochlear nucleus, SOC, lateral leminiscus, inferior colliculus, auditory thalamus and auditory cortex 2.2 Vestibular nervous system • Vestibular nerve • Vestibular nucleus • Other structures: cerebellum, vestibular cortex • VOR and VSR reflex pathways 2.3 Neurotransmitter properties and changes in various neuro-transmitters duet o ageing 2.4 Age at which maturation is attained and age at which decline commences for: • Auditory nervous system • Vestibular nervous system
Unit 3:	**Unit 3: Effect of age on behavioural auditory and vestibular responses 18 Hrs** 3.1 Tests of auditory function • Psychophysical measures o Absolute thresholds o Difference limens for intensity, frequency and duration o Loudness o Pitch • Central auditory processes o Temporal processing o Binaural integration o Binaural interaction o Localization/Lateralization o Binaural separation o Auditory closure 3.2 Tests for vestibular function • Romberg test • Fukuda stepping test • Tandem gait test • Doam and foam test • Past pointing test (finger-to-noise test) • Subjective visual vertical
Unit 4:	**Unit 4: Effect of age on physiological responses of auditory and**

	vestibular systems 18 Hrs 4.1 Physiological assessment of auditory system • Tympanometry and reflexometry • Otoacoustic emissions (TEOAE, DPOAE and fine structure) 4.2 Electrophysiological assessment of auditory system • Auditory brainstem responses to speech and non-speech stimuli • Auditory middle latency responses • Auditory late latency responses to speech and n on-speech stimuli • Other event related potentials – MMN, P_{300}. 4.3 Vestibular electrophysiological changes • Vestibular evoked myogenic potentials o Cervical VEMP o Ocular VEMP • Oculomotor evaluation o Gaze test o Optokinetic test o Smooth pursuit test o Saccade test • Positional and positioning test • Video head impulse test • Bithermal caloric test • Computerized dynamic posturography • Rotary chair test
PRACTICUM	
Existing	***Proposed***
	1. Collect and watch videos and slides showing embryological developmental, maturation and ageing associated changes in the audio-vestibular system; explain the changes observed. 2. Make separate test protocols for auditory and vestibular system assessment for infants, toddlers, and older adults. 3. Write reports about all the above
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Existing	***Proposed***

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Existing	*Proposed*
8806 Clinical Behaviour Analysis	**Clinical Behaviour Analysis**
Course: Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100

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.	**Objectives** After successful completion of the course student will be: • Prepared in the specific area of clinical behavior analysis, therapy or change programs for affected individuals with communication disorders. • Trained in practical skills and competencies required for mastering basics of clinical behavior analysis in their practice for identification and management of persons with communication disorders • Sensitized on the ethical aspects of clinical behavior analysis when dealing with individuals or their families with communication disorders. • Able to integrate clinical behavior analysis and counselling based aspects in the field of research in communication disorders.
Unit 1 • 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 1: Introduction** **18 Hrs** 1.1 Learning: Meaning and Types 1.2 Behavioral Perspectives: History to current trends in Behavior Medicine 1.3 Behavioral Theories. Pavlov: Skinner and Watson 1.4 Concept of Behavior Therapy and Behavior Modification 1.5 Behavioral Assessment: Meaning & Characteristics - Behavioral Perspective 1.6 Recent Variations: Applied Behavior Analysis and Dialectical Behavioral Counseling – ABC Model
Unit 2 • Behavior Assessment Scales: Western and Indian-AAMD Adaptive Behavior Scale, BASIC-MR, ACPC-DD, MDPS, etc • Skills, Steps and Strategies: Procedure of Behavior Assessment & Management: Skill Training and Problem Behavior	**Unit 2: Behavior assessment** **18 Hrs** 2.1 Behavior Assessment Scales: Western and Indian-AAMD Adaptive Behavior Scale, ***PBCL,*** BASIC-MR, ACPC-DD, MDPS, etc 2.2 Skills, Steps and Strategies: Procedure of Behavior Assessment &

Remediation • Shaping, Chaining, Prompting, Fading, Modeling, Contingency Contracting, Reward Training, Token Economy, Activity Scheduling, Systematic Desensitization, Flooding, Aversion Techniques, Self Management Techniques: Correspondence Training	Management: Skill Training and Problem Behavior Remediation 2.3 Shaping, Chaining, Prompting, Fading, Modeling, Contingency Contracting, Reward Training, Token Economy, Activity Scheduling, Systematic Desensitization, Flooding, Aversion Techniques, 2.4 Self Management Techniques: Correspondence Training
Unit 3 • Behavior Change Techniques: 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 3: Behavior change techniques** **18 Hrs** 3.1 Behavior Change Techniques: Shaping, Chaining, Prompting, Compliance training, Stress Management/ Relaxation Techniques: JPMR, Yoga – Habit Reversal Techniques – Paradoxical Intention – Negative Practice 3.2 Operant Procedures and Techniques: Counter-Conditioning, Desensitization, Aversive Conditioning Procedures, 3.3 Self-control Procedures and Cognitive Procedures **3.4** Time Out, Over-correction
Unit 4 • Biofeedback: EEG, EMG, GSR, EKG and Thermal – Polygraph; • Cognitive Behavior Techniques: Beck and Ellis – Reality Therapy and Transactional Techniques	**Unit 4: Allied behavioral procedures** **18 Hrs** 4.1 Biofeedback: EEG, EMG, GSR, EKG and Thermal – Polygraph; 4.2 Cognitive Behavior Techniques: Beck and Ellis – Reality Therapy and Transactional Techniques
PRACTICUM	
	1. Interviewing of parents for skill and problem behavior mapping. 2. **Setting behavioural objectives for program planning.**
REFERENCES	
Existing	***Proposed***
Unit 1 1. **Theoretical and experimental bases of the behavior therapy, by Feldman et al, Wiley, London.** 2. **Clinical biofeedback by Kenneth, R.G.**	**Unit 1: Introduction** **1. Feldman, M.P., & Broadhurst, A. (1976).*Theoretical and experimental bases of the behavior therapy*. London: Wiley.**

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**.	**2. Housten, R.V., & Axelrod, S. (1993). *Behavior analysis and treatment*. New York: Springer.** **3. Kearney, A.J. (2007). *Understanding Applied Behavior Analysis: An Introduction.* London: Jessica Kingsley.** **4. Malott, R., Tillema, M., & Glenn, S. (1978). *Behavior analysis and behavior modification: an introduction*. Kalamazoo, MI: Behaviordelia.** **5. Hersen, M. (2005). *Encyclopedia of behavior modification and Cognitive behavior therapy.* California: Sage Publications.** **6. Bellack, S. (1985). *International handbook of behavior modification and therapy.* New York: Plenum Press.** **7. Venkatesan, S. (2004). *Children with Developmental Disabilities: a training guide for parents, teachers and caregivers.* New Delhi: Sage.** **8. Peshawaria, R., & Venkatesan, S. (1992). *Behavior approach in teaching mentally retarded children: a manual for teachers.* Secunderabad: NIMH.**
Unit 2 1. Ramnero, J., & Törneke, N. (2008). *ABCs of human behavior: Behavioral principles for the practicing clinician.* Oakland, CA: New Harbinger & Reno, NV: Context Press. 2. Miltenberger, R.G., (2008). *Behavior modification: Principles and procedures (4th Ed.).* Pacific Grove, CA: Thomson/Wadsworth. 3. Woods, D. W., & Kanter, J. W. (Eds.). (2007). *Understanding behavior disorders: A contemporary behavioral perspective*. Reno, NV: Context Press. 4. Cooper, J.O., Heron, T.E. & Heward, W.L. (2007). *Applied Behavior Analysis (2nd Edition)*. Prentice Hall. 5. Baum, W. M. (2004). *Understanding*	**Unit 2: Behavior assessment** 1. Ramnero, J., & Törneke, N. (2008). *ABCs of human behavior: Behavioral principles for the practicing clinician.* Oakland, CA: New Harbinger & Reno, NV: Context Press. 2. Miltenberger, R.G., (2008). *Behavior modification: Principles and procedures (4^{th} Ed.).* Pacific Grove, CA: Thomson/Wadsworth. 3. Woods, D. W., & Kanter, J. W. (Eds.). (2007). *Understanding behavior disorders: A contemporary behavioral perspective*. Reno, NV: Context Press. 4. Cooper, J.O., Heron, T.E. & Heward, W.L. (2007). *Applied Behavior Analysis (2nd Edition)*. Prentice Hall. 5. Baum, W. M. (2004). *Understanding*

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Unit 3 1. Baldwin, J.D. & Baldwin, J.I. (2000). *Behavior Principles in Everyday Life (4th Edition)*. Prentice Hall. 2. Dougher, M. J. (Ed.). (2009). *Clinical Behavior Analysis.* Reno, NV: Context Press. 3. Chiesa, M. (1994). *Radical Behaviorism: The philosophy and science*. Cambridge Center. 4. Leigland, S. (1992). *Radical behaviorism: Willard Day on psychology and philosophy*. Reno, NV: Context Press. 5. Catania, C. (1992). *Learning*. Prentice Hall. 6. Hayes, S. C. (Ed.). (1989/2004). *Rule Governed behavior: Cognition, contingencies, and instructional control.* New York: Plenum / reprinted in 2004 by Context Press. 7. Skinner, B.F. (1965). *Science and Human Behavior*. Free Press.	**Unit 3: Behavior change techniques** 1. Baldwin, J.D., & Baldwin, J.I. (2000). *Behavior Principles in Everyday Life (4th Edition)*. Prentice Hall. 2. Dougher, M. J. (Ed.). (2009). *Clinical Behavior Analysis.* Reno, NV: Context Press. 3. Chiesa, M. (1994). *Radical Behaviorism: The philosophy and science*. Cambridge Center. 4. Leigland, S. (1992). *Radical behaviorism: Willard Day on psychology and philosophy*. Reno, NV: Context Press. 5. Catania, C. (1992). *Learning*. Prentice Hall. 6. Hayes, S. C. (Ed.). (1989/2004). *Rule Governed behavior: Cognition, contingencies, and instructional control*. New York: Plenum / reprinted in 2004 by Context Press. 7. Skinner, B.F. (1965). *Science and Human Behavior*. Free Press.
Unit 4 ***1. Culbert, T.P. "Biofeedback with Children and Adolescents." In Innovative Psychotherapy Techniques in Child and Adolescent Therapy. , edited by C. Schaefer. 2nd ed. New York: John Wiley and Sons, 1999.*** ***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.***	**Unit 4: Allied behavioral procedures** **1. Culbert, T.P. (1999). *Biofeedback with Children and Adolescents.* *In Innovative Psychotherapy Techniques in Child and Adolescent Therapy.* , Edited by C. Schaefer. New York: John Wiley.** **2. Di Franco, J.T. (2000). *Biofeedback.* *In Childbirth Education: Practice, Research and Theory,* Edited by F. H. Nichols and S. S. Humenick. Philadelphia: W. B. Saunders.** **3. Schwartz, M.S. (1987). *Biofeedback: A Practitioner's Guide.* New York: Guilford.** **4. Spencer, J.W., & Jacobs, J.J. (1999). *Complementary/Alternative Medicine:***

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Existing	
Clinical Neuro-Psychology	
Course: Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks**: (25 + 25 + 50) 100	
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.	
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 Clinometry: Issues and Problems • Ethical Issues in Assessment of Children and Elderly • Test Battery Approaches: LNNB and HRNTB – Adult and Child Versions; Geriatric Neuro-psychology: • Indian Scales: AIIMS Neuropsychological Test Battery, NIMHANS Neuro-psychological Test Battery and Functional Neuro-psychological Assessment Battery – Structure and Observation of Clinical Testing	
Unit 3 • Clinical Neuro-psychological 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	
PRACTICUM	
Existing	
REFERENCES	
Existing	
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. 3. Luria, A.R. (1973). *The Working brain: An introduction to neuropsychology*. New York: Basic Books. 4. Fletcher-Janzen, E. Reynolds, C. R., Strickland, T. L., et al. (Eds.) (2000). *Handbook of cross-cultural neuropsychology*. Kluwer Academic Publishers. (ISBN 0 306 463237) 5. Rosenzweig, M.R., Leiman, A.L. & Breedlove, S.M. (1999). *Biological psychology: An introduction to behavioral, cognitive, and clinical neuroscience* (2nd ed.). Sunderland, MA: Sinauer Associates, Inc. 6. Sunderland, M.A.(1998). *Introduction to behavioral, cognitive, and clinical neuroscience* (2nd ed.). Sinauer Associates, Inc. 7. Trimble, M. (1996). *Biological Psychiatry* (2nd ed.). New York: Wiley. 4	
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Unit 3 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. 3. Franzen, M.D., and Robbins, D.E. (2000). Reliability and Validity in Neuropsychological Assessment. Second Edition. New York: Springer-Verlag. 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.	

III Semester	
Existing	***Proposed***
99042 Implantable Devices for Individuals with Hearing Impairment	**Implantable Devices for Individuals with Hearing Impairment**
Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
Objectives: At the end of the course, the student shall be able:	**Objectives:** At the end of the course, the student shall be able to:

• 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	• Identify, describe the types of implantable **hearing** devices and **describe** the purpose(s) of each component used in implantable **hearing** devices. • Select candidates for implantable **hearing** devices. • Assess **and counsel** the benefit from implantable **hearing** devices. • Suggest schemes / loans to obtain implantable hearing devices.
Unit 1 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 1: Partial and total implantable hearing aids** **10 Hrs** 1.1 Bone-conduction implantable devices • Candidacy • Components • Overview to surgery • Types bone conduction implantable devices (Percutaneous & Transcutaneous) 1.2 Middle ear implants • Candidacy • Components • Overview to surgery 1.3 Types of middle ear implants • **Partial implantable and Totally implantable devices** • **Electro-mechanical and piezo-electric** **1.4 Evaluation of bone-conduction implantable devices & middle ear implants** • Pre-operative evaluation • Fitting • Assessment of benefits 1.5 **Counselling regarding partial and total implantable hearing aids** • Care and maintenance • Trouble shooting of the device
Unit 2 Cochlear implants - ***History***	**Unit 2: Cochlear implants** **14 Hrs** **2.1 Introduction to cochlear implants** • **Overview to development of**

- 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	**cochlear implants** • Overview to biological safety • Surgical procedures in brief • Complications and immunization • **International and national regulations for implantable devices** **2.2 Cochlear implant features** • Types: Bilateral implants, hybrid implants, bimodal implants • Components • **Coding strategies within and across companies** • **Device failure (hard and soft)** 2.3 Candidacy • Non-audiological criteria • Audiological criteria • Role of team members in candidacy selection • Expansion of cochlear implant candidacy 2.4 Pre-operative evaluation for children and adults • Behavioural: Speech and non-speech • Objective: OAE, Immittance evaluation, Auditory evoked potentials including eABR 2.5 Counseling (pre-operative) • Realistic expectations; Predictors of benefit from cochlear implants including genetic predictors • Role of team • Loan, insurance • Pre-operative counseling; **Procedure for obtaining consent** • Contraindication for cochlear implants
Unit 3 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	**Unit 3:Mapping / Programming 18 Hrs** 3.1 **Overview to Mapping / Programming** • Pre-requisites for mapping: pre-implant radiological report, Post-implant radiological report; Discharge report of surgeon; Non-physiological objective measures (electrode impedance, compliance, electrode voltage)

- Evaluation of benefits b) **Current trends and** future needs in implantable devices	• Map parameters: Pulse width, stimulation rate, maxima, frequency allocation and re-distribution , • Mapping of those with malformations of the cochlea • Effect of map parameters on loudness and pitch perception 3.2 **Mapping procedure** • Mapping using behavioural measures • Mapping using objective measures (ECAP & ESRT) **3.3 Evaluations** • Assessment of benefit: Non-speech and speech tests • Electrophysiological measures (EABR and other evoked potentials) • Optimization of: Hearing aid in the contralateral ear for bimodal implants; Bilateral cochlear implants; Electroacoustic stimulation 3.4 Overview to psychophysics of perception through cochlear implants: Intensity discrimination, loudness perception, loudness growth, loudness adaptation, loudness summation, pitch discrimination, gap detection, frequency resolution, temporal integration, masking, binaural phenomenon. 3.5 Counseling (post-operative) • Care and maintenance, trouble shooting • Counseling regarding outcome measures and follow-up • Counseling regarding importance of habilitation • Warranty.
Unit 4: 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	**Unit 4: Brainstem implant, midbrain implants** 4.1 Candidacy for **Brainstem implant, Midbrain implants** • **Non-audiological criteria** • **Audiological criteria** • Surgical procedures in brief 4.2 Pre-operative evaluation for children and

perception, loudness growth, loudness adaptation, loudness summation, pitch discrimination, gap detection, frequency resolution, temporal integeration, 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***	adults; ABI/MBI team 4.3 Components, types, features; **Mapping procedure of Brainstem implants, Midbrain implants** 4.4 Post implant evaluation and **benefits** from Brainstem implant, Midbrain implants 4.5 Future needs in implantable devices (**implantable hearing aids, cochlear implants, brainstem implant, midbrain implants)**
PRACTICUM	
Existing	***Proposed***
-	1. Observation of mapping and recording NRT in cochlear implantees and write an analytic report. 2. From 10 case files, make recommendations for further testing to decide candidacy for implantable devices. 3. Compile information from 10 case files of individuals with hearing impairment (5 children & 5 adults) and make recommendations whether implantable devices are to be recommended or not. 4. Simulate map parameters to increase 'C' / 'M' levels. 5. Compile map parameters of implantable devices available in India.
REFERENCES	
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Existing	*Proposed*
88043 Speech Perception	**Speech Perception**
Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
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.	**Objectives:** After completing this course, the candidate should be able to 1. Explain coding of speech in the auditory pathway in normal hearing individuals 2. Explain basic concepts regarding speech perception 3. Critically evaluate theories of speech perception and methods to synthesis speech 4. Describe the major and minor acoustic cues for speech perception in normal hearing individuals 5. Explain about speech perception in relation to short term memory 6. Describe aspects related to dichotic speech perception 7. Compare **adult,** infant and animal speech perception.
Unit 1 **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 1: Introduction to and theories of speech perception 18 Hrs** **1.1 Basic concepts.** • **Differentiation of Hearing, Listening and Perception, Comprehension** • **Overview on the acoustic cues of different classes of speech sounds** **1.2** Categorical perception • Definition • Evidence for and against categorical and continuous speech perception **1.3** Normalization in speech perception • Definition • Methods used for normalization of vowels and consonants **1.4** Coding of speech in the auditory pathway • Coding in the **cochlea** and auditory nerve • Coding in the central **auditory** pathway

	1.5 Theories of speech perception • Acoustic theory • Neurological theory • Auditory theory • Motor theory and its revisions • Analysis-by-synthesis • **Dual stream theory** • **Reverese hierarcy theory**
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: o Stops o Fricatives o Affricates o Nasals • Major and minor cues to differentiate between Stops, Fricatives, Affricates, Nasals • Acoustical parameters used to differentiate vowels from consonants	**Unit 2: Perceptual cues for vowels and consonants 18 Hrs** **2.1** Perception of vowels and diphthongs in normals: • Major and minor cues to identify vowels and diphthongs • Major and minor cues to differentiate vowels from diphthongs **2.2** Perception of consonants in normals: • Major and minor cues to identify place, manner and voicing in: Stops, Fricatives, Affricates, Nasals • Major and minor cues to differentiate between Stops, Fricatives, Affricates, Nasals • Acoustical parameters used to differentiate vowels from consonants
Unit 3 **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 3: Speech synthesis, co-articulatory perception and perception of suprasegmentals 18 Hrs** **3.1 Methods used to synthesize speech for perceptual experiment** • **Pattern play-back** • Analysis by synthesis • Parametric synthesis • Articulatory synthesis **3.2** Effects of co-articulation on speech perception: • **Basic concepts in coarticulation and methods to study coarticulatory perception** • Perception of vowels from consonantal segmental cues • Perception of consonants from vowel

	segmental cues **3.3 Perception of suprasegmental cues in normal hearing individuals** • **Perception of stress,** • **Perception of rhythm** • **Perception of intonation**
Unit 4 **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	**Unit 4: Factors related speech perception** **18 Hrs** 4.1 Short term memory and speech perception • Stages of memory, coding and capacity at the different stages • **Models** of short term memory: **Dual coding Model, Modal model, A model for auditory memory and contrast, Working memory model** • **Role of short term memory in the perception of consonants and vowels** 4.2 Dichotic listening • Factors affecting dichotic perception • Stimulus parameters • Procedure parameters • Subject parameters 4.3 Infant perception • Methods of studying infant speech perception • Theories of infant speech perception: **Universal theory, Attunement theory, Perceptual Learning theory, Maturational theory, perceptual magnetic theory** • Studies to support the theories • Perception of consonants and vowels in infants • Comparison of adult and infant perception 4.4 Animal speech perception • **Overview on methods to study animal speech perception** • Need to study animal • Perception of consonants and vowels • Categorical perception and

	normalization • Animal Vs. human perception
PRACTICUM	
Existing	***Proposed***
	1. Observe the spectra, waveforms and spectrograms of various vowels and consonants and note down your observations **2. Note down the difference in the perception of consonants/vowels are truncated from CVC or VCV** **3. Synthesize stop consonants using analysis by synthesis, parametric synthesis and articulatory synthesis** **4. Use synthesized VOT continuum and F2 transition continuum to study categorical perception using discrimination and identification tasks** **5. Note down the cross linguistic differences in speech perception in at least two languages.** **6. Test recency and precedence using words**
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Existing	***Proposed***
88044 Seminars in assessment of Hearing Impairment	**Seminars in assessment of Hearing Impairment**
Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
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**	**Objectives** After completing this **course**, the student shall be able to describe: **1. Sign and Symptoms related to various peripheral and central auditory disorders.** **2. The test battery for differential diagnosis of various auditory disorders.** **3. The relationship between histopathology of the disorder and**

		audiological test findings. 4. **The different non-audiological tests and their importance in diagnosis of various auditory disorders.** 5. **The findings, pathophysiology, probable cause and counsel regarding appropriate management options to the clients.**
	Unit 1: Correlation of audiological ***(and non-audiolgical wherever necessary)*** findings to histopathological findings in Conductive hearing loss	**Unit 1: Correlation of audiological findings to histopathological findings in conductive hearing loss 18 Hrs** **1.1 Disorders of pinna and external auditory canal** **1.2 Disorders of tympanic membrane** **1.3 Disorders of ossicular chain** **1.4 Other disorders related to middle ear cavity including tumors of the middle ear**
	Unit 2: Correlation of audiological (and non-audiolgical wherever necessary) findings to histopathological findings in a) Cochlear pathology b) Retro-cochlear pathology	**Unit 2: Audiological findings and its relationship to histopathological findings cochlear and retrocochlear pathologies 18 Hrs** **2.1 Cochlear pathologies-Mineres disease, presbycusis, ototoxicity, noise induced hearing loss, sudden sensorineural hearing loss, systemic diseases, autoimmune disorders** **2.2 Retrocohlear pathologies-Space occupying lesions, auditory nerve tumors, auditory neuropathy, Other demyelinating disorders**
	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	**Unit 3: Assessment of hearing in individuals with co-existing conditions 18 Hrs** 3.1 Assessment of auditory disorders in the special population such as • Deaf-blind • **Intellectually challenged** • **Pervasive developmental disorders** • Cerebral palsy 3.2 Assessment of patients with hyperacusis • Conditions/disorders in which it

	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	occurs • Tests and interpretation • Implications of the findings in rehabilitation 3.3 Assessment of patients with Vestibular problems • Condition/disorders in which it occurs • Tests, interpretation • Implications of findings in rehabilitation 3.4 Assessment of patients with Tinnitus • Condition associated with tinnitus • Types of tinnitus • Evaluation • Implications of findings in rehabilitation
	Unit 4 Genetic hearing loss 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 Lab tests for differential diagnosis of auditory disorders	**Unit 4: Genetic hearing loss and non-audiological evaluations 18 Hrs** 4.1 Genetic hearing loss • Basics of Genes and genetic hearing loss • Audiological and non-audiological tests for identifying genetic hearing loss, • Gene mapping, amniocentesis • Gene therapy • Genetic counselling 4.2 Non-audiological tests • Clinical neurological examination • X-rays • CT Scan • MRI • FMRI • PET • **SPECT** 4.3 Lab tests for differential diagnosis of auditory disorders
PRACTICUM		
	Existing	***Proposed***
		1. Administration and interpretation of various audiological tests on individuals with simulated conductive pathology (2 participants).

		2. Administration and Interpretation of various audiological tests on individuals with simulated cochlear pathology (2 participants). 3. Administration and Interpretation of various audiological tests on individuals with various retrocochlear pathology (5 participants). 4. Administration and Interpretation of various tests of Tinnitus in normal subjects (2 participants). 5. Administration and Interpretation of various vestibular tests on normal hearing individuals (2 participants).
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Existing	*Proposed*
88045 Seminars in Rehabilitative Audiology	**Seminars in Rehabilitative Audiology**
Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
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.	**Objectives** At the end of the course, the student shall 1. Know about various types of recent devices and advances in technology with respect to amplification/assistive devices. 2. Know selection strategies and optimization of hearing aids, critically review selection procedures of the hearing device 3. Be able to prepare the programs and intervention strategies as per the different needs of the clients having different auditory disorders across different **age groups** 4. **List specific needs and know psychosocial and communicative demands and strategies to solve these**
Unit 1 Advances in 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	**Unit 1: Advances in hearing aid and hearing assistive technology** **18 Hrs** **1.1 Application of recent advances in hearing aids and hearing assistive technology (HAT)** • **Compression and expansion, directionality, advanced signal processing techniques including noise reduction algorithms, wireless technology, data logging, trainable hearing aids, occlusion reduction, application of nanotechnology in hearing aids, others** • Speech cue enhancement – spectral shape, duration, intensity, enhancement of CVR, speech simplification, re-synthesis • **Enhancement of perception through telephone/mobile phone**

nanotechnology in hearing aids (d) ***Hair cell regeneration, gene therapy for hearing loss, auditory deprivation, toughening, genetic counseling***	• Techniques to control acoustic feedback, distortion, circuit noise. • **Electromagnetic interference – measurement, solutions; techniques to improve compatibility of hearing aids with mobile phones** **1.2** Application of LASER technology in ear mould production, ear mould modifications – **physical and acoustic modification;** **1.3 Electroacoustic measurement of hearing aids** • **Advanced methods in electro-acoustic measurements of hearing aids including directionality, group and phase delay, DNR algorithm, and ALDs** • **Variables affecting electroacoustic measurements** • **Comparison of International and Indian standards/legislations for hearing aids and ALDs.**
Unit 2:Electroacoustic measurement of hearing aids ***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 2:Fitting of hearing aid and hearing assistive devices 18 Hrs** **2.1 Selection, verification and validation of hearing aids and hearing assistive devices.** • **Pre-selection: Factors affecting pre-selection, assessment of listening needs of the individuals with hearing impairment** • **Critical analysis of hearing aid selection procedures: Prescriptive and comparative procedures** • **Objective procedures for hearing aid fitting (ABR, ALLR, ASSR and others)** • **Hearing aid programming and optimization** • **Hearing aid verification using insertion gain measurements and sound field measurement including**

	verification of advanced features • **Validation** **2.2 Hearing aid fitting for children** • **Special considerations while fitting hearing aids for infants and children in terms of pre-selection, selection, verification (including advanced features) and validation** • **Different protocols used (Minnesota early hearing detection and intervention (EHDI) program, American Academy of Audiology clinical practice guidelines)** **2.3 Hearing aid fitting considerations for older adults** **2.4 Management of other hearing disorders** • **Sudden hearing loss, unilateral hearing loss** • **High frequency hearing loss** • **Cochlear dead region, auditory dysynchrony, management of auditory dysynchrony vs. CAPD** • **Cerumen management** **2.5 Fitting of HATs** • **Pre-selection: Factors affecting pre-selection, assessment of needs for HAT** • **Selection, verification and validation of HATs for different age groups** **2.6 Future trends in hearing aids and HATs: Technology and fitting strategies**
Unit 3: 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***	**Unit 3: Rehabilitation of individuals with hearing impairment 18 Hrs** **3.1 Counselling the hearing aid and HAT users** • **Overview to counselling theories/techniques** • **Realistic expectations, adjusting to hearing device, other management options**

others) - ***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***	• Care and maintenance of HATs for **individuals with different age groups** • Trouble shooting and fine tuning/optimization of hearing aids and HAT **3.2 Management of children with hearing impairment** • **Criteria for selecting different auditory listening programs; using an eclectic approach in providing listening training; criteria for transition from one method to the other as a child grows** • **Adapting AVT techniques for Indian languages and late identified children** • **Providing group listening training activities for children having different listening skills** • **Selection of language for training based on native language and regional language** **3.3 Rehabilitation of adults and older adults** • **Justification for providing auditory listening / speech reading training for older adults including auditory plasticity** • **Techniques for adults and older adults** • **Variables that affect the communication and the role of the communication partner** • **Planning training activities; assertiveness training** **3.4 Measuring therapy outcome** • **Importance of outcome** • **Measurement of therapy outcome for different age groups** • **Comparison of outcome across different methods of training**
Unit 4: Rehabilitation of individuals with hearing impairment (i) ***Early identification and intervention***	**Unit 4: Rehabilitation of multiple handicapped and tinnitus 18 Hrs** 4.1 Management of the children/adult with

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*** ***4 Formal and informal education*** ***5 International and national policies/acts related to educational facilities (Biwako millennium framework, Salamanca statement, DPEP scheme, PWD act, UNCRPD)*** ***6 Measures to implement these policies/acts in India.*** ***7 Audit facilities in India*** ***(iii) Rehabilitation of geriatrics*** ***8 Listening training, speech reading, speech/discourse tracking*** ***9 Communication strategies*** ***10 Assertiveness training*** (iv) Strategies for management of the children/adult with multiple handicapped 11 Hearing impairment with visual problems. 12 Hearing impairment with cognitive problems 13 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	multiple handicapped • **Hearing aid fitting considerations, strategies used and the outcome with different strategies for individuals with hearing impairment with visual problems; cognitive problems; neuro-motor problems** 4.2 Audiological management of tinnitus • Models related to tinnitus management: patho-physiological and neurophysiological model • Overview to non-audiological management techniques for tinnitus • Audiological management techniques for those with normal hearing and different degrees of hearing loss (TRT, counselling, others) and their outcomes 4.3 **Audiological management of hyperacusis** • **Models related to hyperacusis management; overview to non-audiological management techniques for hypercusis** • **Audiological management techniques for normal hearing and different degrees of hearing loss and their outcomes**

hearing and different degrees of hearing loss (Masking, TRT, Counselling, others) Management outcomes.	
PRACTICUM	
Existing	***Proposed***
-	• **To carry out electro-acoustic measurements of digital hearing aids including directionality, group and phase delay, DNR algorithms, and HATs; comparison of EAC across different standards and write down the observations (1 hearing aid).** • **To program advanced features of recent digital hearing aids (2 hearing aids).** • **To carry out insertion gain measurements and RECD measurements (2 individuals).** • **To watch videos on AVT and discuss strategies used.** • **To collect and observe the videos of counseling the patients with tinnitus and hyperacusis.**
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14. Valente, M., & Hosford-Dunn. H. (2000). Audiology treatment. New York: Thieme Medical Publishers Inc.	13. Valente, M., & Hosford-Dunn, H. (2000). Audiology treatment. New York: Thieme Medical Publishers Inc.
15. Vernon, J.A (1998). Tinnitus- Treatment and Relief. United States of America: Allyn and Baccon.	14. **Wong, L., & Hickson, L. (2012). Evidence-based practice in audiology: Evalauting interventions for children and adults with hearing impairment. San Diego: Plural Publishing Inc.**

	Existing	*Proposed*
	88024 Vestibular System: Assessment & Management	**Vestibular System: Assessment & Management**
	Course: Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Soft Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
1.	**Objectives** • ***To apply information regarding the vestibular system in Audiological practice***	**Objectives** **After passing this course, the student should be able to** **1. Describe the anatomy and physiology of the human vestibular system** **2. Perform the tests for vestibular assessment and interpret the results** **3. Identify various vestibular pathologies and differentially diagnose one from the others** **4. Carry-out vestibular rehabilitation and make appropriate referrals**
	Unit 1 ***Anatomy and physiology of vestibular system*** ***Anatomy of central vestibular path way and its connections***	**Unit 1: Anatomy & physiology of the systems involved in balance maintenance 12 Hrs** **1.1 Anatomy and physiology of peripheral vestibular system** • **Semicircular canals** • **Utricle** • **Saccule** • **Vestibular nerve** **1.2 Anatomy of the central vestibular pathway and its connections** • **Brainstem** • **Cerebellum** • **Vestibular cortex** **1.3 Reflexes involving the vestibular system** • **Vestibulo-ocular reflex- pathways from each of the semicircular canals, cranial nerves involved (cranial nerves II, IV and V)** • **Vestibulo-spinal reflex** • **Sacculocollic reflex** **1.4 Other systems involved in balance** • **Proprioceptive (somatosensory)**

		system- location of various receptors, strategies used for maintaining balance like ankle, hip, and step strategies • **Visual system: Various kinds of eye movements like gaze, saccade, optokinetic and pursuit** **1.5 Association between vestibular system and cognition**
	Unit 2 ***Systems involved in balance disorders – Ocular system, sensory and proprioception receptors, cerebellum and its central connections, systemic and neurological disorders involving these systems.***	**Unit 2: Assessment of vestibular system 15 Hrs** **2.1 Questionnaire based assessments** • **Questionnaires for screening and diagnosis (Standard case history, Vertigo symptom scale, Motion sensitivity quotient)** • **Questionnaires for quality of life assessment (Dizziness handicap inventory, Activities-specific balance confidence scale, Vestibular disorders activities of daily living, visual analog scales)** **2.2 Behavioral tests for bedside assessment, and diagnosis- background, technique involved, interpretation and usefulness** • **Romberg test** • **Fukuda stepping test** • **Tandem gait test** • **Past pointing test (Finger-to-nose test)** • **Tests for cerebellar function (Alternate pronation-supination of palm, tracking of shin bone by the heel, use of appropriate strategies to pick up objects)** • **Head impulse test** • **Head shake test** • **Glycerol test** **2.3 Physiological/electrophysiological tests- background, technique involved, interpretation and usefulness** • **Rotatory chair test (sinusoidal harmonic acceleration, visual-vestibular interaction tests,**

		vestibular ocular reflex suppression test, step velocity test) • **Craniocorpography** • **Computerized dynamic posturography** • **Ocular motility testing using ENG/VNG (gaze, optokinetic, saccade and pursuit)** • **Positional/positioning tests** • **Caloric test using ENG/VNG (monothermal, bithermal and Cobrax test; use of Alexander's law)** • **VEMP (cervical, ocular and other variants)** • **Sclera coil search test** • **Video head impulse test** • **Subjective visual vertical and horizontal tests** • **Vestibular autorotation test**
	Unit 3 ***Diseases of vestibluar nerve, schwannomas, patho-physiology of the diseases*** ***Involving peripheral and central vestibular disorders, BPPV, evaluation of the vestibular system.***	**Unit 3: Disorders of the vestibular system 15 Hrs** **3.1 Diseases of the vestibular labyrinth** • **Meniere's disease** • **Benign paroxysmal positional vertigo** • **Labyrinthitis** • **Perilymph fistula** • **Superior semicircular canal dehiscence** • **Diabetes mellitus** **3.2 Diseases of the nerve** • **Vestibular neuritis** • **Auditory neuropathy spectrum disorders** • **Vestibular schwannomas** • **Diabetes mellitus** **3.3 Diseases of the central nervous system** • **Generalized neuropathy involving multiple systems** • **Multiple sclerosis** • **Tumors of CP angle and other cranial tumors**

		• **Cerebro-vascular accidents involving vestibular cortex and cerebellum** • **Vertebro-basilar insufficiency** • **Migraine** • **Meningitis and encephalitis** **3.4 Age-related degeneration** **3.5 Vestibular disorders in children**
	Unit 4 ***History taking in vertigo patients*** ***Clinical test in balance disorders*** ***ENG – procedure and clinical implication*** ***Medical management and rehabilitation of vertigo patients***	**Unit 4: Management of vestibular dysfunction 12 Hrs** **4.1 Treatments for unilateral and bilateral vestibular loss** **4.2 Medical and surgical management of vertigo** • **Vestibular suppression** • **Dietary modifications** • **Surgeries** **4.3 Non-medical management of vertigo** • **Brandt-Daroff exercises for positional vertigo** • **Repositioning maneuvers for BPPV (Epley maneuver, Semont liberatory maneuver, Canalith repositioning maneuver, Gans repositioning maneuvers, Barbeque roll maneuver, Appiani maneuver, Guffoni liberatory maneuver)** • **Other vestibular rehabilitation exercises** **4.4 Rehabilitation of children with disequilibrium**
PRACTICUM		
		1. **Watch videos and slides of vestibular system's anatomy and physiology.** 2. **Perform behavioral balance assessment using Romberg test, Fukuda stepping test, Tandem gait test, past pointing tests on 10 healthy individuals.** 3. **Perform tests for cerebellar function like alternate pronation-supination**

		of palm, tracking of shin bone by the heel, use of appropriate strategies to pick up objects on 5 healthy individuals. **4. Perform head impulse test, head shake test and subjective visual vertical (bucket test) on 5 healthy individuals.** **5. Obtain cVEMP and oVEMP from 5 healthy individuals.** **6. Perform vHIT on 5 healthy individuals.** **7. Carry out tests for peripheral and central vestibular dysfunction (ocular motility testing) using ENG/VNG on 5 healthy individuals.** **8. Observe the procedure for bithermal caloric test.** **9. Watch the videos of various repositioning maneuvers and vestibular rehabilitation exercises and administer them on 5 healthy individuals.** **10. Write reports about all the above.**
REFERENCES		
	Existing	***Proposed***
	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***	**Unit 1: Anatomy & physiology of the systems involved in balance maintenance** **1. Ackley, R. S., Decker, T. N., & Limb, C. J. (2007). An essential guide to hearing and balance disorders. New Jersey: Lawrence Erlbaum Associates Inc. Publishers.** **2. Biswas, A. (1998). An introduction to neurotology. Mumbai, India: Bhalani Publishing House.** **3. Claussen, C. F., De Sa, J. V., Estelrrich, P. & Kirtane, M. V. (1978). Clinical study of human equilibrium by electronystagmo-graphy and allied tests. Bombay, India: Popular Prakashan.** **4. Desmond, A. L. (2004). Vestibular**

	11. *Glasscock shambugh surgery of the ear* 12. *Grays anatomy 39th edition* 13. *Gyton and hall text book of medical physiology 11th edn.*	**function: evaluation and treatment. New York: Thieme Medical Publishers Inc.** **5. Deviterne, D., Gauchard, G. C., Jamet, M., Vancon, G., & Perrin, P. P. (2005). Added cognitive load through rotary auditory stimulation can improve the quality of postural control in the elderly. *Brain Research Bulletin*, 64, 487-492.** **6. Furman, J. M., Cass, S. P., & Whitney, S. L. (2010). New York: Oxford University Press Inc.** **7. Guidetti, G. (2013). The role of cognitive processes in vestibular disorders. *Hearing, Balance and Communication*, 11, 3-35.** **8. Hitier, M., Besnard, B., & Smith, P. F. (2014). Vestibular pathways involved in cognition. Frontiers in Integrative Neuroscience, 8(59), 1-16. doi: 10.3389/fnint.2014.00059** **9. Hughes, G. B., & Pensak, M. L. (2007). Clinical Otology. New York: Thieme Publishers, Inc.** **10. Jackler, R. K., & Brackmann, D. E. (2005). Neurotology. 2nd Ed. Philadelphia: Elsevier Mosby.** **11. Jacobson, G. P., & Shepard, N. T. (2008). Balance function assessment and management. San Diego: CA: Plural Publishing Inc.** **12. McCaslin, D. L. (2013). Electronystagmography and videonystagmography ENG / VNG. San Diego: Plural Publishing Inc.** **13. Shepard, N. T., & Telian, S. A. (1997). Practical management of the balance disorders patient. New York: Thomson Delmar Learning.** **14. Woollacott, M., & Shumway-Cook, A. (2002). Attention and the control of posture and gait: A review of an emerging area of research. *Gait and***

		***Posture*, 16, 1-14.**
		Unit 2: Assessment of vestibular system **1. Biswas, A. (1998). An introduction to neurotology. Mumbai, India: Bhalani Publishing House.** **2. Biswas, A. (2009). Clinical audio-vestibulometry for otologists and neurologists. 4th Ed. Mumbai, India: Bhalani Publishing House.** **3. Cohen, H. S., & Sangi-Haghpeykar, H. (2012). Subjective visual vertical in vestibular disorders measured with the bucket test. *Acta Otolaryngologica*, 132(8), 850-854.** **4. Desmond, A. L. (2004). Vestibular function: evaluation and treatment. New York: Thieme Medical Publishers Inc.** **5. Funabashi, M., Santos-Pontelli, T. E. G., Colafemina, J. F., Pavan, T. Z., Carneiro, A. A. O., & Takayanagui, O. M. (2012). A new method to analyze the subjective visual vertical in patients with bilateral vestibular dysfunction. *Clinics*, 67(10), 1127-1131.** **6. Hughes, G. B., & Pensak, M. L. (2007). Clinical Otology. New York: Thieme Publishers Inc.** **7. Jackler, R. K., & Brackmann, D. E. (2005). Neurotology. 2nd Ed. Philadelphia, USA: Elsevier Mosby.** **8. Jacobson, G. P., & Shepard, N. T. (2008). Balance function assessment and management. San Diego, CA: Plural Publishing Inc.** **9. McCaslin, D. L. (2013). Electro-nystagmography and video-nystagmography ENG / VNG. San Diego, CA: Plural Publishing, Inc.** **10. Murofushi, T., & Kaga, K. (2009). Vestibular evoked myogenic potential- its basics and clinical applications. Tokyo, Japan: Springer.**

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		Unit 3: Disorder of the vestibular system **1. Ackley, R. S., Decker, T. N., & Limb, C. J. (2007). An essential guide to hearing and balance disorders. New Jersey: Lawrence Erlbaum Associates Inc.** **2. Biswas, A. (1998). An introduction to neurotology. Mumbai, India: Bhalani Publishing House.** **3. Biswas, A. (2009). Clinical audio-vestibulometry for otologists and neurologists. 4th Ed. Mumbai, India: Bhalani Publishing House.** **4. Desmond, A. L. (2004). Vestibular function: evaluation and treatment. New York: Thieme Medical Publishers Inc.** **5. Furman, J. M., Cass, S. P., & Whitney, S. L. (2010). New York: Oxford University Press Inc.** **6. Gaertner, C., Bucci, M. P., Obeid, R., & Wiener-Vacher, S. (2013). Subjective visual vertical and postural performance in healthy children. *PLOS One*, 8(11), e79623, doi:10.1371/journal.pone.0079623.** **7. Hughes, G. B., & Pensak, M. L. (2007). Clinical Otology. New York: Thieme Publishers Inc.** **8. Jackler, R. K., & Brackmann, D. E. (2005). Neurotology, 2nd Ed. Philadelphia, USA: Elsevier Mosby.** **9. Jacobson, G. P., & Shepard, N. T. (2008). Balance function assessment and management. San Diego: Plural Publishing Inc.**

		10. Kaga, K., & Starr, A. (2009). Neuropathies of the auditory and vestibular eighth cranial nerves. Tokyo, Japan: Springer. **11. Kaga, K. (2014). Vertigo and balance disorders in children. Tokyo, Japan: Springer.** **12. Kithara, M. (1990). Meniere's disease. Tokyo, Japan: Springer-Verlag.** **13. Kohan, D., Heman-Ackah, S. E., & Chandrasekhar, S. S. (2014). Neurotology- what do I know? New York: Oxford University Press.**
		Unit 4: Management of vestibular dysfunction **1. Arenberg, I. K., & Graham, M. D. (1998). Treatment options for Meniere's disease endolymphatic sac surgery- do it or don't do it. San Diego, CA: Singular Publishing Group Inc.** **2. Biswas, A. (1998). An introduction to neurotology. Mumbai, India: Bhalani Publishing House.** **3. Desmond, A. L. (2004). Vestibular function: evaluation and treatment. New York: Thieme Medical Publishers, Inc.** **4. Furman, J. M., Cass, S. P., & Whitney, S. L. (2010). New York: Oxford University Press Inc.** **5. Hughes, G. B., & Pensak, M. L. (2007). Clinical Otology. New York: Thieme Publishers, Inc.** **6. Jackler, R. K., & Brackmann, D. E. (2005). Neurotology, 2nd Ed. Philadelphia, USA: Elsevier Mosby.** **7. Jacobson, G. P., & Shepard, N. T. (2008). Balance function assessment and management. San Diego, CA: Plural Publishing Inc.** **8. Kaga, K. (2014). Vertigo and**

		balance disorders in children. Tokyo, Japan: Springer. **9. Kithara, M. (1990). Meniere's disease. Tokyo, Japan: Springer-Verlag.** **10. Shepard, N. T., & Telian, S. A. (1997). Practical management of the balance disorders patient. New York: Thomson Delmar Learning.**

	Existing	*Proposed*
	88002 Auditory Physiology	**Auditory Physiology**
	Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Soft Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
		Syllabus given in I Semester (1.4)

Existing	*Proposed*
88005 Technology for Speech-Language & Hearing	**Technology for Speech-Language & Hearing**
Course: Soft Core **Credits:** 02 (L:T:P = 1:1:0) **Contact Hours:** 1L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Soft Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
	Syllabus given in I Semester (1.4)

IV Semester	
Existing	***Proposed***
88101 Assessment and Management of CAPD	**Assessment and Management of CAPD**
Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
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	**Objectives** After completing this subject, the candidate should be able to 1. List the types of **CAPD** and explain their physiological bases. 2. List the signs and symptoms of **CAPD** and correlate them with different central auditory processes. 3. List different tests of **CAPD** and independently design appropriate test protocol for clients with different signs and symptoms. 4. List and explain the factors affecting the assessment. **5.** Explain construction and standardization of test of **CAPD.** 6. Explain management strategies and techniques for improving different central auditory processes.
Unit 1: Introduction to (Central) Auditory Processing Disorder [(C) APD] & Screening • Definition • Processes involved such as o Binaural integration o Binaural separation o Temporal processing o Auditory closure o Binaural interaction o Phoneme synthesis o Auditory memory and sequencing o Sound localization and lateralization • Neural maturation and auditory processing • Neural degeneration and auditory processing • Signs and symptoms of (C) APD • Classification of auditory processing	**Unit 1: Introduction to central auditory processing disorder (CAPD) & screening 18 Hrs** 1.1 **Overview to CAPD** • Critical evaluation of definitions of **CAPD** • Processes **and cognition** involved in **CAPD:** o Binaural integration o Binaural separation o Temporal processing o Auditory closure o Binaural interaction o Phoneme synthesis o Auditory memory and sequencing o Sound localization and lateralization 1.2 Neural maturation and auditory processing; Neural degeneration and

disorder • (C) APD as a co-morbid disorder • Screening for (C)APD o Questionnaires based o Sub-tests of speech / language tests o Audiological tests	auditory processing 1.3 Signs and symptoms in individuals with specific central auditory deficits 1.4 Classification of auditory processing disorder; **CAPD** as a co-morbid disorder 1.5 Screening for **CAPD** • **Need / utility of screening for CAPD** • **Screening** questionnaires / **check lists for children and adults; Sensitivity and specificity** • **Screening tests for children and adults; Sensitivity and specificity** o Sub-tests of speech / language tests o Audiological tests
Unit 2: Diagnostic Assessment of APD • Physiological assessment in assessment of APD **such as** o ABR o AMLR o ALLR o MMN o P300 o Contralateral suppression of OAEs • Behavioural tests in assessment of (C) APD o **Tests for assessing** temporal processing o **Tests for assessing** Binaural interaction o **Tests for assessing** Binaural integration/separation o Monaural low redundancy tests o Tests for assessing auditory memory and sequencing • Assessment of (C) APD in subjects with peripheral hearing loss • Factors affecting assessment of (C) APD o Factors related to subject o Factors related to procedure • ***Construction and standardisation of tests for assessment of (C) APD***	**Unit 2: Diagnostic assessment of CAPD** **18 Hrs** 2.1 Physiological assessment in assessment of CAPD: • ABR, AMLR, ALLR, MMN, P300 and other potentials • Contralateral suppression of OAEs 2.2 Behavioural tests in assessment of CAPD/ **cognition:** • Temporal processing • Binaural interaction • Binaural integration • Auditory separation / closure • Tests for assessing auditory memory and sequencing • Assessment of CAPD in subjects with peripheral hearing loss • Selection of CAPD tests based on signs and symptoms / performance on screening tools 2.3 Factors affecting assessment of CAPD • Factors related to subject • Factors related to procedure 2.4 B**ehavioural and physiological tests:** • Relation between behavioural and physiological tests in different processes 2.5 **Performance on** tests of CAPD/ **order cognition in:**

	• **Children** • **Young adults** • **Older adults**
Unit 3: Overview to management of (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 o Bottom-up approaches o Top-down approaches • Phoneme synthesis training • Metacognitive and metalinguistic approaches	**Unit 3: Overview to management of CAPD 18 Hrs** 3.1 Direct remediation techniques • Bottom-up approaches • Top-down approaches • Environmental modifications in school set-ups, work place; Compensatory strategies for children and adults 3.2 Devices for subjects with auditory processing disorder; Outcome measures of devices for CAPD 3.3 Phoneme synthesis training; Vigilance training; Auditory memory and sequencing training 3.4 Meta-cognitive and meta-linguistic approaches 3.5 Role of auditory plasticity in management of CAPD
Unit 4: Management of (C) APD – Process specific techniques • Auditory perceptual training for problems in o Binaural integration o Binaural separation o Temporal processing o Auditory closure o Binaural interaction o Phoneme synthesis o Auditory memory and sequencing o Sound localization and lateralization • Factors affecting management of (C) APDs • Team approach for assessment and management of (C) APD	**Unit 4: Techniques and outcome of Process specific management of CAPD 18 Hrs** 4.1 Auditory perceptual training for binaural integration and binaural separation 4.2 Auditory perceptual training for temporal processing **(temporal ordering, temporal resolution, etc)** 4.3 Auditory perceptual training for auditory closure 4.4 Auditory perceptual training for binaural interaction & **s**ound localization and lateralization 4.5 Factors affecting management of CAPDs; Team approach for assessment and management of CAPD
PRACTICUM	
Existing	***Proposed***
Nil	• **For the signs and symptoms of CAPD provided by the faculty, select the appropriate tests and list the possible**

	results with justification. • **Administer any two screening tools on 10 children.** • **Administer at least 2 CAPD diagnostic tests on 2 adults, compare with available norms.** • **Based on the CAPD test results make recommendations for management.** • **Write activities for different meta-cognitive strategies** • **Write activities for different meta-linguistic strategies.**
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Existing	***Proposed***
Unit 1 ***1. ASHA Task force (1996). Central auditory processing: current status of research and implications for clinical practice. American Journal of Audiology, 5, 41-54.*** 2. Bellis, T. J. (2003). Assessment and management of central auditory processing disorders in the educational setting – from science to practice. London: Singular publishing group Inc. 3. Bhatnagar, S. C., & Andy, O. J. (1995). Neuroscience for the study of communicative disorders. Baltimore: Williams & Wilkins. 4. Chermak, G. D., & Musiek, F. E. (2006). Handbook of (Central) auditory processing disorders- auditory neuroscience and diagnosis. Volume I. San Diego: Singular Publishing Group Inc. 5. Geffnar, D., & Ross-swain, D. (2007). Auditory processing disorders: assessment, management & treatrment. 6. Katz, J. (1994). Handbook of clinical Audiology. (4th Edn), Baltimore: Williams & Wilkins. 7. Keith, R. W. (2000). SCAN-C: Test for auditory processing disorders in children-revised. Antonio, TX: The Psychological Corporation.	**Unit 1: Introduction to central auditory processing disorders (CAPD) and screening** **1. American Speech-Language-Hearing Association. (2005). *(Central) auditory processing disorder (technical report)* Retrieved from http://www.asha.org/ members/desref-journals/deskref/ default.** 2. Bellis, T. J. (2003). Assessment and management of central auditory processing disorders in the educational setting: From science to practice. London: Singular Publishing Group Inc. 3. Bhatnagar, S. C., & Andy, O. J. (1995). Neuroscience for the study of communicative disorders. Baltimore: Williams & Wilkins. 4. Chermak, G. D., & Musiek, F. E. (2006). Handbook of (Central) auditory processing disorders- auditory neuroscience and diagnosis. Volume I. San Diego: Singular Publishing Group Inc. 5. Geffnar, D., & Ross-swain, D. (2007). Auditory processing disorders: assessment, management & treatment. 6. Geffner, D., & Ross-Swain, D. (2013). Auditory Processing Disorders: Assessment, management, and treatment. 2nd Edn. San Diego: Plural

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Unit 2	**Unit 2: Diagnostic assessment of APD**
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Existing	*Proposed*
88062 Audiology in Practice	**Audiology in Practice**
Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
Objectives After studying this subject: 1. ***Student should*** know the role of an Audiologist in different set-ups 2. ***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. 3. ***Student should know the national and international*** legislations relating people with hearing disability. 4. ***Student should*** know the role played by an Audiologist in legal matters. ***5. Student should be aware of the welfare measures for the people with hearing disability.***	**Objectives** After studying this course, student should be able to 1. Know the role of an Audiologist in different set-ups. 2. Liaison with other professionals in setting-up an audiological clinic. 3. **Audit the practices in existing set-ups.** 4. **Implement** acts and legislations concerned with hearing disability. 5. Know the role of Audiologist in legal matters.
Unit 1 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 ▪ Neurologocal setup ▪ Otolaryngological setup ▪ Industrial setup ▪ School set up ▪ Private practice c) Auditing progress in different setups ▪ Method to audit	**Unit 1: Audiology practice in different eet-ups 18 Hrs** 1.1 Scope, challenges and solutions of audiological practices in • Rural/tribal areas • Medical setup • Industrial setup • School setup • Private practice 1.2 **Tele-practice in Audiology** • **Concept of tele-practice** • **Need for tele-practice** • **Method, infrastructure and human resource requirement** • **Advantages and limitations of tele-practice** **1.3 Allied professionals to be involved and their scope in screening / diagnostic work in** • **Rural/tribal areas** • **Paediatric set-up** • **Neurological set-up**

▪ Goals to be achieved ▪ Measures to be taken to prevent malpractice by allied professionals	• **Otolaryngological set-up** • **Industrial set-up** • **School set-up** **1.4 Marketing, business, fundraising in Audiological practice** • **Need** • **Strategies** • **Ways to overcome problems**
Unit 2 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 2: Construction and development of audiology set-ups 18 Hrs** 2.1 **Designing acoustically treated rooms:** • **Transmission loss** • **Reverberation control** • **Illumination** • **Electrical connections-electrical shielding, grounding and connecting jacks** • **Professionals involved in designing/construction audiological test facility** **2.2 Differences in the infrastructure (equipment, space, room design, financing) requirements for** • **Rural/tribal areas** • **Paediatric set-up** • **Neurologocal set-up** • **Otolaryngological set-up** • **Industrial set-up** • **School set-up** • **Private practice** • **Audiology practice in medical collages and hospitals** **2.3 Setting up of a speech and hearing college** **2.3 Auditing Processes in different set-ups** • **Method to audit** • **Goals to be achieved** • **Measures to be taken to prevent malpractice by allied professionals**
Unit 3 a**) Designing acoustically treated rooms:** ▪ **Transmission loss** ▪ **Reverberation control** ▪ **Illumination**	**Unit 3: Welfare measures for individuals with hearing-impairment 18 Hrs** **3.1 Scope of different Government departments/ non-Government**

▪ **Electrical connections** o **Electrical shielding, grounding** o **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**	**organizations in prevention, identification, rehabilitation and follow-up of individuals with hearing impairment:** • **Health & Family Welfare** • **Women & Child Development** • **Social Justice & Empowerment** • **Education Department** • **Human Resource Department** • **Others Government Departments** • **Non-Government Organization** **3.2 Facilities available for the individuals with hearing impairment in India** • **Comparison with other disabilities** **3.3 Role of the audiologist as a policy maker** • **In committees dealing with disability issues (Eg. RCI, PWD Act)** • **In committees dealing with hearing devices (Eg. BIS, ADIP scheme)**
Unit 4 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, SarvasikshaAbhiyan • BiwakoMillinenium 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**	**Unit 4 : Law and audiology 18 Hrs** 4.1. Ethics in practice (in India and in other countries) 4.2. Medico-legal aspects in Audiology • Forensic Audiology • Audiologist as an expert witness • Report writing 4.3 Auditing of implementation of Acts and Legislations: • PWD act, RCI act, FDA, UNCRPD, NPPCD, Sarvasiksha Abhiyan • Biwako Millinenium Framework, Salamanca statement and framework • Insurance Against Malpractice, Consumer Protection Act, Evidence Act

disability issues (Eg. RCI, PWD Act) In committees dealing with hearing devices (Eg. BIS, ADIP scheme)	
PRACTICUM	
	1. To explain various legislations and National Acts such as - PWD Act, RCI Act, FDA, UNCRPD, NPPCD, Sarvasiksha Abhiyan. **2. To explain Biwako Millinenium Framework, Salamanca statement and framework.** **3. To explain various welfare measures for the individuals with hearing impairment in India regarding travel, education, vocation, others, comparison with other disabilitie.** **i. RCI, PWD Act** **ii. BIS, ADIP scheme** **4. To prepare a project proposal for developing an audiology clinic in one of the following set-ups** **i. Rural/tribal areas** **ii. Paediatric set-up** **iii. Neurological set-up** **iv. Otolaryngological set-up** **v. Industrial set-up** **vi. School set-up** **5. Make an indent for procurement of an audiological equipment.**
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Existing	*Proposed*
88063 Speech Perception in Clinical Population	**Speech Perception in Clinical Population**
Course: Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100	**Course:** Hard Core **Credits:** 03 (L:T:P = 2:1:0) **Contact Hours:** 2L + 2T / week **Marks:** (25 + 25 + 50) 100
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	**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 1: Perception of vowels and consonants in individuals with hearing impairment 18 Hrs** 1.1 Perception of vowels, semivowels, and diphthongs in individuals with hearing impairment. 1.2 Perception of consonants in individuals with a hearing impairment. 1.3 Effect of type, degree and audiogram configuration in perception of vowels and consonants.
Unit 2: **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	**Unit 2: Perception of coarticulation and suprasegmental 18 Hrs** 2.1 Perception of coarticulation in individuals with hearing impairment. • Perception of vowels from adjacent consonantal segmental cues. • Perception of consonants from adjacent vowel segmental cues. • Perception of vowels from adjacent vowel segmental cues.

• Influence of direction of coarticulation on perception **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	• Perception of consonants from adjacent consonant segmental cues • Influence of direction of coarticulation on perception. 2.2 Perception of suprasegmental cues in individuals with hearing impairment: • Perception of stress, • Perception of rhythm • Perception of intonation 2.3 Perception of speech through the visual modality • Perception of segmental and suprasegmental cues 2.4 Perception of speech through the tactile modality • Perception of segmental and suprasegmental cues 2.5 **Audio-visual integration of speech in individuals with SN hearing loss**
Unit 3: **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	**Unit 3: Speech perception through different devices 18 Hrs** 3.1 Perception of speech through cochlea implants • Overview of speech perception through single channel implants: ▪ Vowels perception ▪ Consonants perception ▪ Speech identification scores ▪ Suprasegmental cues 3.2 Perception through multi-channel cochlear implants • Vowels perception • Consonants perception • Speech identification scores • Suprasegmental cues **3.3 Effect of the following on speech perception** • **Coding strategy** • **Threshold, comfort levels and Dynamic range**

• ***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	• **Frequency allocation of electrodes** • **Number of channels and maximas** • **Stimulation rate and pulse width** • **Pre-processing strategies and other noise reduction procedures** **3.4** Speech perception through **implanted hearing aids, middle ear implants,** auditory brain-stem implants and **mid-brain implants** 3.5 Perception of speech through digital hearing aids • Influence of out-put limiting circuits on perception for different degrees of hearing loss and audiogram configuration • Influence of number of channels on perception for different degrees of hearing loss and audiogram configuration
Unit 4: **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	**Unit 4: Speech intelligibility and listening in adverse listening conditions** **18 Hrs** 4.1 Speech intelligibility • Subjective procedures ○ Perceptual tests to evaluate perceptual deviance ○ Perceptual procedures to evaluate production deviance • Objective procedures ○ Articulation index and its modifications ○ Speech transmission index • Comparison of subjective and objective procedures • Factors influencing speech intelligibility ○ Stimulus based factors ○ Subject based factors ○ Transmission based factors **4.2** Speech perception in adverse listening conditions • Effect of noise on speech perception in normal and the hearing impaired ○ Effect of different types of noise ○ Effect of different signal-to-noise

normal and the hearing impaired ○ Effect of different types of noise ○ Effect of different signal-to-noise ratios ○ Effect on different age groups ○ Effect on different degrees of hearing impairment • Effect of reverberation on speech perception ○ Effect of different reverberation times ○ Effect on age different age groups ○ Effect on different degrees of hearing impairment • Combined effect of noise and reverberation on speech perception • Effect of nonnative accent on speech perception **c)** Application of speech perception in: • Evaluation of the hearing impaired • Rehabilitation of the hearing impaired Research regarding the hearing impaired	ratios ○ Effect on different age groups ○ Effect on different degrees of hearing-impairment • Effect of reverberation on speech perception ○ Effect of different reverberation times ○ Effect on age different age groups ○ Effect on different degrees of hearing-impairment • Combined effect of noise and reverberation on speech perception • Effect of nonnative accent on speech perception **4.3** Application of speech perception in: • Evaluation of the hearing impaired • Rehabilitation of the hearing impaired • Research regarding the hearing-impaired.
PRACTICUM	
Existing	***Proposed***
NIL	**1. Evaluate the importance of burst and transition on perception of stops in 5 individuals with simulated conductive hearing loss** **2. Evaluate the importance of burst and transition on perception of stops in 5 individuals with simulated SN hearing loss with different cutoff frequencies** **3. Measure the effect of number of channels, frequency band on speech perception in cochlear implant simulated speech on normal hearing adults** **4. Measure speech perception for CV syllables and words in various SNR and reverberation times** 5. **Calculate audibility index for 5 different degree and 5 different configuration of hearing loss with and without correction factors**
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Existing	***Proposed***

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Existing	***Proposed***
88028 Open elective: Signal Processing Strategies and Their Implementation in Hearing Aids	**Open elective: Signal Processing Strategies and Their Implementation in Hearing Aids**
Course: Open Elective **Credits:** 04 **Contact Hours:** 3 hrs/week **Marks:** (25 + 25 + 50) 100	**Course:** Open Elective **Credits:** 04 **Contact Hours:** 4 hrs/week **Marks:** (25 + 25 + 50) 100
Objectives: a) To give an overview of the latest technology of hearing aids b) To provide fundamental concepts of	**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	digital signal processing. c) To learn the various signal processing strategies used in hearing aids d) To understand and observe the effects of signal processing strategies. e) To learn the procedures for electroacoustic evaluation of hearing aids. f) To learn how to setup and use the equipment for measurement of spectral and temporal characteristics analysis of hearing aid output.
Unit 1: Introduction to Hearing aid components – *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 1: Introduction to hearing aid components 12 Hrs** 1.1 Hearing aid components • Microphones: Basic structure & principle of operation of **electret microphones, single port and dual port microphones and microphones in body worn, BTE & ITC hearing aids, microphone sensitivity** • Telecoil: Basic structure, principle of operation & frequency response of active and passive telecoil • Receivers: Basic structure & principle of operation of **moving coil and balanced armature type receivers.** 1.2 Hearing aid controls and their variations • Volume control • OTM switch • **Battery door switch** • Output control • Other trimmer controls 1.3 Hearing aid accessories • Battery: Various types and their characteristics • Chords: Various types • Ear hooks: **Types and frequency shaping**

	• Connecting tube: **Types and frequency shaping**
Unit 2: Introduction to Digital signal processing 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 2:Introduction to digital signal processing 12 Hrs** 2.1 Digital signal processing • Basic structure of a Digital signal processing system • Process of Analog to Digital conversion • Process of Digital to Analog conversion • Basic concepts of Digital Signal Processing - Decomposition, Processing and Synthesis 2.2 Implementation of ***Signal processing functions*** using DSP • Amplifiers • **Filters** • **Types of digital filters** • **Basic architecture of a fully digital Hearing Aid** 2.3 **Advantages of DSP in hearing aid signal processing** • **Major characteristics of DSP** • **Advantages of DSP analog processing** • **Features in hearing aids due to DSP**
Unit 3: Signal processing in Hearing aids 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 3: Signal processing in hearing aids 15 Hrs** 3.1 Nonlinear amplification • Basic technology - Input compression, output compression • Dynamic characteristics • BILL & TILL • Channel Separation 3.2 WDRC & Output limiting • Signal processing techniques for Implementation of WDRC • **Negative effects of DSP based WDRC** • Signal processing techniques for output Limiting 3.3 Noise reduction & feedback cancellation • Signal processing techniques for noise reduction

	• Noise reduction through microphone technology
Unit 4: Objective studies on hearing aids • Electroacoustic parameters of hearing aids – National and International Standards • Equipment setup for objective studies of hearing aids • Equipment setup and techniques for measurement and analysis of temporal parameters of hearing aids. • Equipment setup and techniques for measurements and analysis of spectral parameters ***Introduction to Matlab, how to use Matlab effectively for objective studies on hearing aids*.**	**Unit 4: Objective studies on hearing aids** **15 Hrs** 4.1 Electroacoustic parameters • Procedure of electroacoustic evaluation defined by International Standards • National standards and the difference in procedures • ISTS Stimuli • Equipment setup for electroacoustic evaluation 4.2 Objective studies of temporal behaviour • Equipment setup • Techniques for measurement • Techniques for analysis 4.3 Objective studies of spectral behaviour • Equipment setup • Techniques for measurement • Techniques for analysis
PRACTICUM	
Existing	***Proposed***
	1. Basic structure of transducers. 2. Measuring electroacoustic parameters 3. Objective studies of temporal behavior 4. Objective studies of spectral behavior
REFERENCES	
Existing	***Proposed***
1. Hearing aid Handbook -2011 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 2nd 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 6th Ed.	**Unit 1: Introduction to hearing aid components** 1. Crocker, M.J. (1998). *Handbook of Acoustics,* New York: John Wiley & Sons, Inc., 2. Rossing, T.D. (2002). *The Science of Sound 3rd Edn.,* Glenview: Pearson Education, Inc., 3. Vonlanthen, A. (2007). *Hearing Instrument Technology for the Hearing Health Care Professionals*. London: Singular Publishing Group **4.** Dillon, Harvey (2001). *Hearing Aids*.

Jack Katz 6. Science of Sound Addison Wesley 3rd Ed. Richard Moore, Ruossing, Thomas D. Wheeler Paul A. 7. Introduction to Digital Signal rocessing Prentice-Hall of India Pvt., Ltd., Johnson, Johnson R 8. Applications of Digital Signal Processing to Audio and Acoustics Kulwer Academic Publishers Brandenburg, Kerlheinz **9.** Cochlear Implants Springer Richard R. Fay, Popper, Arthur N. Zeng, Fan Gang	New York: Thieme Medical Publications. **Unit 2: Introduction to digital signal processing** 1. Schaub, Arthur. (2008). *Digital Hearing Aids.* New York: Thieme Medical Publishers, Inc. 2. Malvino, A. P. (1979). *Digital Computer Electronics.* Bombay: Tata McGraw Hill 3. Tan, Li Jiang. (2013). *Digital Signal Processing: Fundamentals and Applications 2nd Ed.* New York: Academic Press Inc **Unit 3: Signal processing in hearing aids** 1. Schaub, Arthur. (2008). *Digital Hearing Aids.* New York: Thieme Medical Publishers, Inc. 2. Vonlanthen, A. (2007). *Hearing Instrument Technology for the Hearing Health Care Professionals*. London: Singular Publishing Group 3. Valente, Michael. (2002). *Hearing Aids: Standards, Options and Limitations*: New York: Thieme Medical Publishers. **4.** Sandlin, R.E. (2002). *Handbook of Hearing Aid Amplification, Volume I: Theoretical and Technical Considerations,* London : Singular Publishing Group, Inc. **Unit 4: Objective studies on hearing aids** *1.* Vonlanthen, A. (2007). *Hearing Instrument Technology for the Hearing Health Care Professionals*. London: Singular Publishing Group 2. Valente, Michael. (2002). *Hearing Aids: Standards, Options and Limitations*: New York: Thieme Medical Publishers. 3. Sandlin, R.E. (2002). *Handbook of Hearing Aid Amplification, Volume I: Theoretical and Technical Considerations,* London : Singular Publishing Group, Inc.

Existing	*Proposed*
88027 Early Identification of Hearing Impairment	**Prevention and Screening of Hearing Impairment**
Course: Open Elective **Credits:** 04 **Contact Hours:** 3 hrs/week **Marks:** (25 + 25 + 50) 100	**Course:** Open Elective **Credits:** 04 **Contact Hours:** 4 hrs/week **Marks:** (25 + 25 + 50) 100
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	**Objectives:** After studying this **course**, the **students** are expected to **appreciate** the: 1. Importance of prevention and early identification of hearing impairment 2. Ways to prevent hearing impairment 3. Ways to screen hearing impairment at early stage 4. Need for early rehabilitation 5. Need for counselling and making appropriate referrals
Unit 1: 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 1: Hearing and hearing loss 18 Hrs** **1.1 Physical attributes of sound** 1.2 **Overview of the ear, its function** 1.3 Role of hearing, **impact of hearing loss**, classification of hearing impairment 1.4 Causes of hearing loss **1.5 Signs and symptoms of hearing impairment** **1.6** Development of human auditory behavior

Unit 2: ***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 2: Prevention and early identification of hearing impairment 18 Hrs** 2.1 Need for prevention and early identification of hearing impairment 2.2 Different levels of prevention – **primary, secondary and tertiary** 2.3 Critical age concept and sensitivity period for language acquisition 2.4 Requirements of a good screening tool **2.5 Subjective test procedures and interpretation (Case history, check lists, behavioural observation)**
Unit 3: Tests for early identification of hearing impairment Informal tests procedure (Case history, behavioral observation) **3.1 Formal tests procedure** (**HRR**, behavioral observation, Screening OAE, Screening ABR) 3.2 Individual and group screening / Mass media screening tests 3.3 Diagnostic test procedure including Electrophysiological tests (Stimuli, procedures, recording of response) 3.4 Interpretation of the test results, Validation and referrals	**Unit 3: Screening for hearing impairment 18 Hrs** 3.1 Objective screening tests procedure (OAE and ABR) 3.2 Individual and group screening / **Role of** mass media in screening 3.3 Interpretation of screening results and appropriate referrals **3.4 Sensitivity and specificity of different screening tools** 3.5 **Strategies to ensure follow-up of referred clients**
Unit 4: ***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***	**Unit 4: Early intervention of hearing impairment 18 Hrs** 4.1 Need for early intervention 4.2 Counselling and referral for therapeutic management 4.3 Team members and their role 4.4 **Overview to management techniques** (hearing devices, modes of communication and modes of education)
PRACTICUM	
Existing	***Proposed***
	1. Prepare a chart on development of auditory behaviour. 2. Administration of hrr on caregivers or significant others of at least 2 children.

	3. Administer hearing screening tests and use of noise makers in at least 3 children. 4. Observation of hearing evaluation and hearing aid trial of children and adults (1 each). 5. Observation of auditory training (2 sessions). 6. Maintenance of record of the above.
REFERENCES	
Existing	***Proposed***
Unit 1: 1. ***Martin, F.N. (1978). Paediatric Audiology, New Jersey: Prentice Hall.*** 2. ***Martin, F.N. (1991), Introduction to Audiology, IV Edition, New Jersey: Frentice Hall.*** 3. Newby, H.A. (1985), Audiology, Ed. 5. Englewood Cliffs, N.J: Prentice Hall. 4. Northern, J.L. and Downs, M.P. (1991). Hearing in children. 3rd Ed. Baltimore: Williams and Wilkins.	**Unit 1: Hearing and hearing loss** 1. Newby, H.A. (1985), Audiology, Ed. 5. Englewood Cliffs, N.J: Prentice Hall. **2. Hayes, D., & Northern, J. L. (1996). Infants and hearing. San Diego: Singular Publishing Group Inc.**
Unit 2: 1. ***Kundu, C. L, (2000) Status of disability in India – RCI Monogram*** 2. Rajeev. J, Aparna. N, & Anuradha. B (2006). Introduction to hearing impairment, DSE (HI) Manual	**Unit 2: Prevention and early identification of hearing impairment** **1. Hayes, D., & Northern, J. L. (1996). Infants and hearing. San Diego: Singular Publishing Group Inc.** **2.** Rajeev, 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 3: Screening for hearing impairment** 1. Newby, H.A. (1985), Audiology, Ed. 5. Englewood Cliffs, N.J: Prentice Hall. 2. **Hayes, D., & Northern, J. L. (1996). Infants and hearing. San Diego: Singular Publishing Group Inc.**
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***	**Unit 4: Early intervention of hearing impairment** 1. **Hayes, D., & Northern, J. L. (1996). Infants and hearing. San Diego: Singular Publishing Group Inc.** 2. Erber, N.P. (1982), Auditory Training,

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.*** **2. *Foundations of spoken language of Hearing Impaired children.– Daniel Ling -1988 - Alexander Graham Bell Association for the deaf and Hard of Hearing.***	Washington: A.G. Bell Association for deaf.