Master of Science (Audiology)
- M.Sc. (Aud)

SEMESTER SCHEME

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS, NORMS, SCHEME OF EXAM AND CURRICULUM

REVISED SYLLABUS 0F

REHABILITATION COUNCIL OF INDIA

(Statutory body under Ministry of Social Justice & Empowerment)
www.rehabcouncil.nic.in

APPROVED BY

OSMANIA UNIVERSITY

HYDERABAD

WITH EFFECT FROM
ACADEMIC YEAR 2018-19

Master of Science (Audiology)

Regulations, Norms, Scheme of Examination and Curriculum – 2018 (CBCS -Semester scheme)

1.0 Nomenclature

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

Objectives of the M.Sc. (Aud) program

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

- function as teachers and researchers in institutions of higher learning,
- diagnose and manage disorders of hearing and balance across life span,
- counsel and guide persons with disorders of hearing and balance as well as their family members,
- implement rehabilitation programs for persons with hearing and balance disorders,
- to function as the disability certification authority in the field,
- liaise with professionals in allied fields and other stake holders,
- implement prevention and public education programs,
- undertake advocacy measures on behalf of and for persons with hearing and balance disorders,
- advise government and other institutions on legal and policy issues related to persons with hearing and balance disorders, and
- to establish and administer institutions of higher learning in the area.

2.0 Duration of the Course

a. The course shall be of 4 semesters of coursework.

b. The course will commence, latest by, July and all academic activities (classes, examinations, end of instruction) will be conducted as per the almanac prescribed by the University.

c. Each semester will be of a minimum period of 15-16 weeks, excluding examination duration.

d. As far as possible the First & Third semesters of the course will commence, latest by, the last week of July each year. These semesters will end by the 4th week of December each year.

e. At the end of these semesters there shall be examinations, followed by 3 weeks of vacation for students.

f. Similarly, the Second & Fourth semesters will commence in January and end in the May each year

3.0 Medium of instruction

Medium of instruction shall be English

4.0 <u>Eligibility for admission</u>

a. Bachelor in Audiology & Speech Language Pathology (BASLP) or Equivalent degree recognized by the respective university & RCI (including Internship). (2) Internship is mandatory for candidates who passed B.Sc./ its equivalent after 2001. (3) 55% marks for general category/ OBC and 50% for SC/ST/PWD's. (4) The candidates should produce internship completion certificate at the time of counseling, failing which admission will not be considered even though they have been qualified in the entrance examination.

b. **SELECTION PROCEDURE**: Selection is based on entrance examination conducted either by Osmania University or the respective Government institutions.

c. Applicants shall not be older than 30 years on the 1st July of the year of admission.

5.0 Course work:

Each student will pursue the course as in the enclosed course of studies

6.0 Attendance:

6.1 The attendance shall be calculated from the date of commencement of classes as per the almanac communicated by the Osmania University.

6.2 Each candidate should put in at least 80% of attendance in Theory class & 90% attendance in Clinical Practicum in each semester. Failure to put in / meet the required attendance by any student render him / her disqualified to appear in the university examination. The candidate who will not be able to take the examination for want of attendance will be declared as Failed and will have to appear for subsequent exam by putting in required attendance.

6.3 However, there shall be a condonation of 10% on medical grounds, subject to production of medical certificate and payment of condonation fee as prescribed by the University from time to time. The condonation fee is to be paid through DD., drawn in favor of Registrar, Osmania University.

6.4 The students who have put up 40% and above attendance in I semester of I year M.Sc. (Aud) can retain the seat however, the candidate has to repeat the course work. Those candidates having less than 40% attendance in I semester of I year M.Sc. (Aud) has to reappear for entrance examination and join afresh. The students not fulfilling the attendance criteria in remaining semesters have to repeat the course work.

6.5 Attendance at N.C.C. camps or sports or debates or educational excursions or such other activities approved by authorities, will not be counted as absence, however, such absence should not exceed 2 weeks of the total period of instruction

7.0 Scheme of Instruction

7.1 The detailed scheme of examination and paper titles are given in Annexure I

7.2 Dissertation shall be in lieu of a theory paper in IV semester.

7.3 The syllabus of every paper will be of five UNITs

7.4 Hours of instruction (contact hours) per week

Time structure of the program shall be as follows:

Semesters		4	
Weeks per Semester		16	
Days per week		5	80 days per semester
Hours per day		7	560 hours per semester
Semester 1	Theory Clinical	4 papers x 60 hours	240 hours 256 hours
Semester 2	Theory Clinicals	4 papers x 60 hours	240 hours 256 hours
Semester 3	Theory Clinicals Dissertation	4papers x 60 hours	240 hours 192 hours 112 hours
Semester 4	Theory Clinicals Dissertation	3 paper x 60 hours	180 hours 128 hours 240 hours

	Theory	240+240+240+180	900 hrs
	Clinicals	256+256+192+128	832 hrs
	Dissertation	0 + 0 + 112 + 240	352 hrs
	Total		2084 hrs

8.0 Appearance for the Examination: A candidate shall apply for all papers of a semester when

he/she appears for the examination of that semester for the first time.

9.0 Scheme of Examination

9.1 There shall be a University examination at the end of each semester. The duration of the theory exam is 3 hours.

9.2 In case of theory papers the continuous evaluation (IA) will be for 20 marks based on tests, seminars, assignments, etc.

9.3 For clinical practicum, continuous evaluation (IA) will be based on clinical performance of the candidate during the semester and clinical practicum examination at the end of each semester.

10.0 Dissertation

10.1 In Lieu of one theory paper in the 4th semester, each candidate has to submit a dissertation prepared under supervision of core faculty. The topic for dissertation is to be finalized in the beginning of III semester.

10.2 Students shall start the dissertation in the 3rd semester and shall submit the same at the end of 4th semester before final examination. The candidates shall submit four copies of dissertation before the commencement of the theory examination of IV semester.

10.3 One copy will be sent to the University for evaluation by the external examiner and one copy will be given to the internal examiner. The third copy will be retained by the college for library use after declaration of result. The last copy will be retained by the respective college Principal

10.4 The internal examiner will award IA of 25 marks in 3rd semester based on continuous evaluation. In 4th semester an external examiner and internal (guide) shall separately assess the dissertation for 50 marks which will be averaged and a viva voce will be conducted by external examiner in presence of guide for 25 marks.

10.5 Candidates who fail to submit their dissertation on or before the stipulated date shall not be permitted to appear for the final semester examination.

11.0 Board of Examiners, Valuation

11.1 The Chairman, Board of studies- ASLP, Osmania University will get the question papers moderated after receiving them from paper setters.

11.2 There shall be double valuation for the theory papers. In case of discrepancy between the marks awarded by the two examiners is 20% or more, all such cases are evaluated by third examiner. The average of the highest two marks awarded is considered as the final award.

11.3 Clinical examinations (for AUD105 and AUD305) shall be conducted by the designated internal faculty of the department at the end of 1st and 3rd semester. IA marks shall be awarded by all the faculty of the department on the basis of the

assessment of the candidates' work throughout the particular semester

11.4 Clinical examinations (for AUD 205 and AUD 405) will be conducted by external examiner(s) at the end of the 2nd and 4th semester, respectively. Clinical examination shall be with clinical population. The examiners shall also evaluate records of clinical and practical work of the students. An internal faculty member can assist the external examiner(s) in AUD 205 and AUD405 Clinicals (External), but shall not award marks.

11.5 Grace marks to the candidate will be awarded as per University rules.

12.0 Criteria for passing:

12.1 Candidate should secure a minimum of 50% marks in each of the theory papers, 50% marks in practical at semester end examination, and Dissertation. There is no minimum pass mark in internal assessment for theory papers. They should secure an aggregate of 55% for all semesters put together.

12.2 Carry-over of papers: Maximum number of attempts for any paper / clinical practicum / dissertation shall be three inclusive of first attempt. There shall be no supplementary examination.

12.3 Announcement of result, classes and ranks for the course as a whole will be as per the University regulations.

13.0 Provision for Repeaters

13.1 **Promotion to Second Semester**: Candidate should have minimum 80% attendance in theory and 90% attendance in practical's in the first Semester and register for First Semester examination.

13.2 **Promotion to Third Semester**: Candidate should have minimum 80% attendance in theory and 90% attendance in practical's and should have passed 50% of first and Second semester theory papers and all practical papers of First and Second semester.

13.3 **Promotion to Fourth Semester**: Candidate should have minimum 80% attendance in theory and 90% attendance in practical's in the third Semester and register for third Semester examination.

13.4 Backlog exams will be conducted only at the end of second and fourth semester

13.5 **Transitory regulation**: whenever there is a change of syllabus, a candidate will be given one more chance to appear for the examination with existing old syllabus.

13.6 Candidate should complete the course in a total of 4 years, and if he /she fails to do so he / she has to repeat the course work by taking fresh admission in1 year.

COURSE STRUCTURE AND CONTENT & EXAMINATION PATTERN

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

I Semester

Code No	Paper title	Theory Hrs/Wk	Credits/ Wk	Total hrs / Sem.	U/E marks	IA marks	Total marks
AUD101	Research Methods, Epidemiology and Statistics	04	04	60	80	20	100
AUD102	Technology in Audiology	04	04	60	80	20	100
AUD103	Cochlear Physiology	04	04	60	80	20	100
AUD104	Hearing Sciences	04	04	60	80	20	100
AUD105	Clinicals (Internal)	**16**	**04**	**256**	**80(Internal)**	**20**	**100**
TOTAL		**32**	**20**	**496**	**320**	**100**	**500**

II Semester

Code No	Paper title	Theory Hrs/Wk	Credits/ Wk	Total hrs / Sem.	U/E marks	IA marks	Total marks
AUD201	Neurophysiology of Hearing	04	04	60	80	20	100
AUD202	Auditory Perception	04	04	60	80	20	100
AUD203	Auditory Disorders	04	04	60	80	20	100
AUD204	Electrophysiological Assessment	04	04	60	80	20	100
AUD205	**Clinicals (External)**	**16**	**04**	**256**	**100**	**00**	**100**
TOTAL		**32**	**20**	**496**	**420**	**80**	**500**

III Semester

Code No	Paper title	Theory Hrs/Wk	Credits/ Wk	Total hrs / Sem.	U/E marks	IA marks	Total marks
AUD301	Auditory Processing Disorders	04	04	60	80	20	100
AUD302	Advances in the Management of Hearing Loss	04	04	60	80	20	100
AUD303	Speech Perception	04	04	60	80	20	100
ELECTIVE							
AUD304 (a)	Genetics of Hearing and Pediatric Audiology	04	04	60	80	20	100
AUD304 (b)	Age related changes in Audio-Vestibular System						
AUD305	Clinicals (Internal)	12	04	192	**80(Internal)**	**20**	100
	Dissertation	07	01	112	-	25	25
TOTAL		**34**	**21**	**544**	**320**	**205**	**525**

IV Semester

Code No	Paper title	Theory Hrs/Wk	Credits/ Wk	Total hrs / Sem.	U/E marks	IA marks	Total marks
AUD401	Implantable Auditory Devices	04	04	60	80	20	100
AUD402	Vestibular system & its disorders	04	04	60	80	20	100
ELECTIVE							
AUD403 (a)	Audiology in Practice	04	04	60	80	20	100
AUD403 (b)	Clinical Counselling						
AUD404	Dissertation	15	03	240	50	25	75
AUD405	Clinicals (External)	08	04	128	100	00	100
TOTAL		**35**	**19**	**548**	**390**	**85**	**475**

GRAND TOTAL FOR ALL SEMESTERS	Teaching hours	Total Credits	U/E marks	I.A. Marks	Total marks
THEORY	900 hrs	**60**	**1200**	**300**	**1500**
CLINICALS	832 hrs	**16**	**360**	**40**	**400**
DISSERTATION	352 hrs	**4**	**50**	**50**	**100**
GRAND TOTAL	2084 hrs	**80**	**1470**	**530**	**2000**

Others 156hrs (Clinical Conference, Journal Club, Library, etc..)

Award of Grades

Range of % of Marks	Grade Letter	Grade Point
90 to 100	O	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
Less than 50	F	0

Semester Grade Point Average (SGPA)

Credit Points for the paper = No. of Credits assigned for the paper x Grade Point secured for that course/Paper

SGPA indicates the performance of a student in a given Semester. SGPA is based on the total **credit points** earned by the student in all the courses and the total number of credits assigned to the courses/papers in a Semester.

Note: SGPA is computed only if the candidate passes in all the papers (gets a minimum 'E'grade in all the Papers)

Total Credits assigned to all the papers in

Semester	Credits
Semester-I	20
Semester-II	20
Semester-III	21
Semester-IV	19

SGPA = Total Credit Points in the Semester-1 =
Total Credits in the Semester-1

Cumulative Grade Point Average (CGPA)

CGPA refers to the Cumulative Grade Point Average weighted across all the semesters (4 Semesters). CGPA is obtained by dividing the total number of credit points (CPts) in all the semesters by the total number of credits in all the Semesters. The final

result at the end of all the semesters is declared in the form of CGPA.

Note: CGPA is calculated only when the candidate passes in all the papers of all the semesters and should have secured an aggregate of 55% for all semesters put together.

$$\text{CGPA} = \frac{\text{Total CPts of Semester-1} + \text{Total CPts of Semester-2} + \text{Total CPts of Semester-3} + \text{Total CPts of Semester-4}}{\text{Total Credits of Semester-1} + \text{Total credits of Semester-2} + \text{Total credits of Semester-3} + \text{Total Credits of Semester-4}}$$

OR

$$\frac{\text{Total Credits of I Semester} + \text{Total credits of II Semester} + \text{Total credits of III Semester} + \text{Total Credits of IV Semester}}{\text{Semester x Total Credits of II Sem}] + [\text{SGPA of III Semester x Total Credits of III Sem}]. + [\text{SGPA of IV Semester x Total Credits of IV Sem}].}$$

$$\frac{\text{Total Credits of I Semester} + \text{Total credits of II Semester} + \text{Total credits of III Semester} + \text{Total Credits of IV Semester}}{\text{Semester x Total Credits of II Sem}] + [\text{SGPA of III Semester x Total Credits of III Sem}]. + [\text{SGPA of IV Semester x Total Credits of IV Sem}].}$$

[SGPA of I Semester x Total Credits of I Sem]. +[SGPA of II

Note: The result of the successful candidates shall be classified as follows:

i.	First Division with Distinction:	CGPA from 7.55 to 10.00
ii.	First Division:	CGPA from 6.00 to 7.54
iii.	Second Division with 55%	CGPA from 5.55 to 5.99
iii.	*Pass Division*	*CGPA from 5.00 to5.55*

Improvement of Grades and Completion of the Course:

i. Candidates who have passed in a theory paper/papers are allowed to appear again for theory paper/papers only once in order to improve his/her grade, by paying the fee prescribed by the University. Such candidates are allowed to appear for improvement examination only once in the next immediate semester examination only. If candidate improves his/her grade, then his/her improved grade will be taken into consideration for the award of GPA only. The improved grade shall not be higher than A+. Such improved grade will not be counted for the award of prizes/medals, Rank and Distinction. If the candidate does not show improvement in the grade, his/her previous grade will be taken into consideration. Candidates will not be allowed to improve marks/grade in the internal assessment, seminars and Project Work.

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Award of Degree

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

Infrastructure for starting the course

Only institutions who have conducted at least two batches of B.ASLP programs (5 years) and have the infrastructure as given in **Annexure** 1 shall be permitted hereafter to offer Masters' program in Audiology, after due formalities.

Others

On all other issues not mentioned in these rules and regulations like the pattern of question paper, grading, award of grace marks, and declaration of rank, among others, the rules and regulations of the respective University shall prevail.

These revised regulations will apply to students admitted for the academic year 2018-19 and onwards.

Annexure-1

Infrastructure requirements for M.Sc. (Aud) programs (Academic year 2018-19 onwards)

The following are the minimum requirements for starting/continuing M.Sc. (Aud) program. This requirement is over and above the stipulated infrastructure (faculty, clinical staff, and physical) for other programs. This should be read and interpreted in conjunction with the guidelines of RCI for recognition of new/existing programs for recognition.

Human Resource Requirement

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

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

Core faculty to student ratio should always be 1:3 (one faculty member for every 3 students)

Note 1: Allied faculty can be part time functionaries and their appointment can be guided by the requirements in a given semester. Besides, allied faculty can be the same for undergraduate as well as postgraduate courses if the institute also has an undergraduate course.

Note 2: The requirement shown here is exclusively for M.Sc. (Aud) program. Increase in intake should be with proportionate increase in the infrastructure particularly faculty.

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

Faculty and Professional qualification in the core areas

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

*Audiology or Speech-Language Pathology & Audiology

Note 1 :Pay and emoluments for all faculty posts shall be on par with UGC norms. RCI norms shall apply for all other clinical and technical posts

Clinical

The institution should have facility for diagnosis, management and rehabilitation of persons with all types of hearingand balance-related problems across life span.

Size of clinical population: The participating institution must have a clinical load of a minimum of 960 new and 1920 follow up therapy cases in the first and second semesters: and, in addition to this, 960 new and 1920 follow up therapy cases in the third and fourth semesters.

Library

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

Library should have internet and photocopying facilities.

At least 50% of books mentioned under 'Recommended Reading' under each paper must be available. The institution should add minimum one book every year for each subject of study.

There should be active subscription to at least 5 journals (3 international and 2 national journals in the core areas)

Library Staff*

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

b) Library Assistant - 1
   Qualification: Diploma in Library Science

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

Space

Sr. No.		Size	Number (for a batch of 12 students)
a)	Class Rooms	Space @ 10 sq. ft per student + 20 Sq. ft for the teacher: Room with a minimum area of 220 sq. ft.	1 class rooms for a batch of 12 students
b)	Seminar hall	Space to accommodate 50% of total student strength	1 hall for a batch of 12 students
c)	Computer lab/multipurpose Hall	Space to accommodate 50% of total student strength	1 computer lab for a batch of 12 students
d)	Room for reception where patients are registered.	10' x 10'	1 room for a batch of 12 students
e)	Room for case history, diagnostic room and Interviews	6' x 8'	4rooms for a batch of 12 students
f)	Therapy Rooms	6' x 8'	2 rooms for a batch of 12 students
g)	Sound treated room for hearing evaluation - twin-	10' x 14'	1 room for a batch of 12 students

	room set up		
h)	Sound treated room for immittance testing and EP Recording	10’ x 10’	1 room for a batch of 12 students
i)	Lab for vestibular testing	10’ x 10’	1 room for a batch of 12 students
j)	Staff Room	15’ x 20’	1 room
k)	Individual work space (with provision for storage facilities)	10’ x 10’	1 room for every 2 faculty/staff members
l)	Academic/administrative Office	10’ x 10’	1
m)	Principal’s Office room	10’ x 10’	1
n)	Sanitary facilities	Separate facility for males and females, staff/students and clinical population	
o)	Hostel	Separate hostel for Men and Women with dining facility. Accommodation for at least 50% of the student population.	
p)	Barrier free access		
q)	Space for recreation - both indoor and outdoor		

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

Sl. No.	Equipment	For a batch of 12 students
a)	Speech audiometry tests including those for assessment of CAPDs - in different languages	As per course requirement
b)	Diagnostic test material	As per course requirement
c)	Diagnostic/clinical pure tone audiometer	1
d)	Diagnostic immittance audiometer	1
e)	Diagnostic OAE analyzer	1
f)	2-Channel EP System	1
g)	Diagnostic material/equipment for assessment of balance disorders	1
h)	Real ear measuring equipment and hearing aid analyzer	1
h)	Equipment set for making earmolds	1
i)	Hi-Fi Ampli Deck with speakers and good microphone	1
j)	Computer PC-AT with VGA Color Monitor & printer for clinic administration	1
k)	Handheld otoscope	1
l)	Software for signal generation and analysis	

Audio-visual Instruments, Furniture in class rooms, clinical areas, labs and other administrative areas and internet access: Appropriately

Annexure 2

Course Content

M.Sc. (Audiology)

Semester I

AUD 101: Research Methods, Statistics& Epidemiology

60 hours: 100 marks

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

a) clinical research designs and statistical methods,
b) epidemiological issues and its relevance in hearing research,
c) evidence based practice in Audiology, and
d) ethical practices in research

Unit 1: Experimental Designs and Their Applicability in Hearing Research

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

Unit 2: Epidemiology

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

Unit 3: Statistical Measures and their Features

a) Review of data description and exploratory data analysis (Numerical summaries and graphical summaries)
b) Probability concepts and models
c) Statistical Inference – Estimation Confidence Intervals
d) Statistical Inference – Basic concepts related to hypothesis testing –null hypothesis, alternative hypothesis, significance level, statistically significant, critical value,

acceptance / rejection region, p-value, power, types of errors: Type I (✔), Type II (🚲), one-sided (one-tailed) test, Two-sided (two-tailed) test

e) Parametric and non-parametric approaches to hypothesis testing
f) Categorical data analysis - contingency tables, Chi-square test for independence of attributes,
g) Measures of association (Contingency coefficient, Cramer's V), Kappa coefficient

Unit 4: Regression, Univariate and Multivariate Analysis

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

Unit 5: Evidence Based Practice

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

Recommended Reading

- Russell, C., & Jay, L. (2016). Rehabilitation Research: Principles and Applications. Elsevier
- Robert E. Owens Jr., Dale Evan Metz, Kimberly A. Farinella (2014). Introduction to Communication Disorders: A Lifespan Evidence-Based Perspective. Pearson Education
- Laura M. Justice, Erin Redle (2013). Communication Sciences and Disorders: A Clinical Evidence-Based Approach.Pearson Education.
- Robert F. Orlikoff, Nicholas E. Schiavetti, Dale Evan Metz (2014). Evaluating Research in Communication Disorders. Pearson Education
- David L. Irwin, Mary Pannbacker, Norman J. Lass (2013). Clinical Research Methods in Speech-Language Pathology and Audiology.Second Edition. Plural Publishing
- Timothy Meline (2009). A Research Primer for Communication Sciences and Disorders. Pearson Education
- David, L., Maxwell, EikiSatake. (2006) Research and Statistical Methods in Communication Sciences and Disorders.Thomson/Delmar Learning.
- John C Reinard (2006). Communication Research Statistics. SAGE Publications
- Nicholas Schiavetti, Dale Evan Metz (2006). Evaluating Research in Communicative Disorders.Allyn& Bacon
- Tim Pring (2005). Research Methods in Communication Disorders. Wiley
- Donald G. Doehring (2002). Research Strategies in Human Communication Disorders. Pro-Ed
- Carole E. Johnson, Jeffrey L. Danhauer (2002). Handbook of Outcomes Measurement in Audiology. Singular
- David L. Maxwell, EikiSatake (1997). Research and Statistical Methods in Communication Disorders. Williams & Wilkins

AUD 102: Technology in Audiology

Hour - 60 : Marks - 100

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

a) advanced aspects of signal acquisition and processing,
b) development and application of software based tools,
c) development and application of tele-technology, and
d) technology of amplification devices

Unit 1: Fundamentals of Digital Signal Processing & Communication Systems

a) Digitization of data and digital systems; Principles and methods of digital signal processing
b) Fundamentals of communication systems – (i) AM & FM transmission & reception (ii)
Digital modulation techniques, (iii) Satellite communication
c) Transducers and signal generation
c) Biomedical signals &signal processing: Principles of generation of acoustic stimuli
d) Signal acquisition and processing techniques
e) Working principles of EEG / Magnetoencephalography, event related potentials/ evoked potential.
f) High-fidelity sound reproducing systems: Auditorium acoustics

Unit 2: Techniques of Speech Processing and Analysis

a) Artificial neural networks
b) Speech processing and synthesis models and techniques (linear predictive coding, linear prediction model, LPC-based synthesis) and applications, review of signal processing, Fourier transform and short-time speech analysis(energy, zero-crossing rate, autocorrelation function).
c) Voice response system, speaker recognition system and speech recognition system: Speech synthesis methods, speech recognition, speaker recognition, speech coding, and speech enhancement.
d) Basic principles of cepstral analysis, filtering low-time filtering for formant estimation, high-time filtering for pitch estimation, complex cepstrum

Unit 3: Neuro Imaging

a) Principles of neuro imaging techniques - MRI, fMRI,NIRS, CT, PET, SPECT, TMS and MEG and their technology (working principles, interpretation and implications).
b) Synching various speech stimuli and events for fMRI acquisition and speech perception in fMRI
c) Technology available for intra-operative monitoring of sensory and motor functions

Unit 4: Tele-technology

a) Tele-technology: Definition, applications, technology, resources
b) Transmission of information: transmission of patient images, reports, etc.

c) Remote consultations and databases
d) Distance learning- multimedia meeting room / videoconferencing

Unit 5: Software for Analysis

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

Recommended Reading

- Moser, P. (2015). Electronics and Instrumentation for Audiologists. Psychology Press.
- Villchur, E. (1999). Acoustics for Audiologists (1 edition.). San Diego, Calif: Delmar Cengage Learning.
- Baber, C. & Noyes, J.M. (1993). Interactive Speech Technology: Human Factors Issues in the Application of Speech Input Output to Computers. London: Taylor and Francis.
- Daniloff, R.G (1985). Speech Sciences: Recent advances. London: Taylor and Francis.
- Gottingen, M.R.S. (Ed.) (1985). Speech and Speaker Recognition. Basel: Kager.
- Haton, J.P. (Eds) (1981). Automatic speech analysis & Recognition. USA, D. Reidel Publishing Company.
- Keller, E. (ed.) (1994). Fundamentals of Speech Synthesis and Speech Recognition: Basic Concepts, State of the art and Future challenges. New York: John Wiley & sons.
- Morgan, D.P. & Scofield, C.L (1991). NeuralNetworks and Speech Processing. Boston, Kluwer Academic Publishers.
- Nakagawa, S. &etal. (1995). Speech, Hearing and Neural Network Models. Oxford: IOS, Press
- Oppenheim & Schafer (1989). Digital signal processing. New Delhi: Prentice Hall of India.
- Boulston, F. R. & Dvorak, J.D (2015). Matlab Primer for Speech Language Pathology and Audiology. San Diego: Plural Publishing Inc
- Silman,S& Emmer, M.B. (2011). Instrumentation in Audiology and Hearing Science: Theroy and Practice. San Diego: Plural Publishing Inc

AUD 103: Cochlear Physiology

60 hours: 100 marks

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

a) describe the micro and macro structures of cochlea,
b) explain the physiology of cochlea,
c) explain the physiological basis for generation of OAE,
d) use appropriate protocol for recording OAEs in clinics and for research,
e) use appropriate protocol for recording ECochG in clinics and for research, and
f) understand the research needs in physiological measurements of hearing

Unit 1: Cochlear Anatomy

a) Macro & microanatomy of cochlea
b) Homeostatic mechanisms in cochlea
c) Blood supply to cochlea
d) Innervations of cochlea
e) Cochlear regeneration
f) Evolution of human cochlea

Unit 2: Cochlear Physiology

a) Techniques to study hair cell and basilar membrane physiology
b) Basilar membrane mechanics and non-linearity
c) Outer hair cell physiology – different mechanisms involved in hair cell motility
d) Inner hair cell physiology
e) Cochlear non-linearity

Unit 3: Development of cochlea and top down control of sensory process

a) Efferent control of cochlear hair cells
b) Nutrients related to sensory cell physiology
c) Ontogenetic development of cochlea
d) Phylogentic development of cochlea
e) Developmental changes in the cochlea; effect of advancing age on cochlea
f) Comparative physiology of auditory system in non-mammalian species

Unit 4: Otoacoustic Emissions

a) Classifications of OAEs; mechanism based taxonomy
b) Characteristics of different types of OAEs
c) Instrumentation and techniques for recording different types of OAEs
d) Factors affecting different types of OAEs
d) Fine structure DPOAEs
e) Suppression of OAEs: ipsilateral, contralateral, and bilateral
f) Clinical applications of OAEs

Unit 5: Cochlear Potentials

a) Endocochlear potentials.
b) Electrocochleograhy: Instrumentation and technique
b) Protocol for recording ECochG
c) Interpretation of ECochG
d) Clinical application of ECochG

Recommended Reading

- Altschuler, R. A., & Hoffman, D. W. (1986). Neurobiology of hearing: the cochlea. New York: Raven Press.
- Berlin, C. I. (1996). Hair cells and hearing aids. San Diego: Singular Publishing Group.
- Dallos, P. (1973). Auditory periphery: Biophysics & physiology. New York: Academic Press.
- Dallos, P., Popper, A. N., & Fry, R. R. (1996). The cochlea. New York: Springer.
- De Reuck, A. V. S., & Knight, J. (1968). Hearing mechanisms in vertebrates. London: Churchill.
- Dhar, S and Hall, J.W. (2011). Otoacoustic emissions: Principles, Procedures and Protocols. San Diego: Plural Publishing Inc
- Drescher, D. G. (1985). Auditory biochemistry. Springfield: Charles C. Thomas.
- Flock, A., Ottoson, D., &Ulfendahi, M. (1995). Active hearing. Baltimore: Williams & Wilkins.
- Gelfand, S. A. (2004). Hearing: Introduction to Psychological and Physiological Acoustics. (4thEdn.). New York: Marcel Decker.
- Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson.
- Jahn, A. F., & Santos-Sacchi, J. (1989). Physiology of the Ear. New York: Academic Press.
- Kemp, D. T. (1986). Otoacoustic emissions, travelling waves, and cochlear mechanisms.
  Hearing Research. 22, 95-104.
- Moller, A. R. (2000). Hearing: Its physiology and pathology. San Diego: Academic Press.
- Moore, B. C. J. (1995). Hearing. San Diego: Academic Press.
- Musiek, F.E. &Baran, J.A. (2016). Auditory System: Anatomy, Physiology and Clinical Correlates. San Diego: Plural Publishing Inc
- Robinette, M. S., &Glattke, T. J. (1997). Otoacoustic emissions: clinical applications. New York: Thieme Medical Publications.
- Zemlin, W. R. (2010). Speech & Hearing Science: Anatomy & Physiology. Boston: Allyn & Bacon.

AUD 104: Hearing Sciences

Marks -100: Hours - 60

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

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

Unit 1: Introduction to Psychoacoustics

a) Physical description and parameters for generation of sounds: Sine wave and complex signals; Analysis of sound: Spectrum and spectrogram, LTASS; Filters and their properties
b) Theory of signal detection: Basic concepts and applications of signal detection
c) Psychophysical methods - Classical and adaptive methods

Unit 2: Thresholds and Loudness

a) Overview of absolute and relative measures: Methods of measuring absolute and relative thresholds; thresholds of audibility (MAP & MAF); Models of loudness.
b) Loudness perception in normal hearing persons
c) Effect of hearing impairment on perception of loudness
d) Dynamic range of hearing, equal loudness contours and loudness scaling.
e) Recruitment and softness imperceptions
f) Consequences of altered loudness perception
g) Factors affecting loudness: Bandwidth, duration, adaptation and masking.
h) DLI

Unit 3: Pitch

a) Theories of pitch perception - simple and complex signals
b) Pitch scales
c) Factors affecting pitch perception
d) Perception of pure-tones by persons with normal hearing and those with hearing impairment
d) Perception of complex signals by persons with normal hearing and those with hearing impairment
e) DLF

Unit 4: Peripheral Masking

a) Critical band concept and power spectrum model
b) Estimating the shape of auditory filter: Psycho-physical tuning curve; Notched noise;
   Non-simultaneous masking
c) Auditory filter shapes in normal hearing and hearing impaired
d) Masking patterns and excitation patterns in normal hearing and hearing impaired

Unit 5: Non-Peripheral Masking

a) Central masking
b) Informational masking
c) Overshoot phenomena
d) Co-modulation masking release
e) Effect of hearing loss on non-peripheral masking

Recommended Reading

- Brain C.J., Moore (2007). Cochlear Hearing Loss: Physiological, Psychological and Technical Issues. England: John Wiley and Sons Ltd.
- Brain, C.J. Moore (1998). Cochlear Hearing Loss. (2nd and 3rd Editions). London: Whurr Publishers.
- Gelfand, S, A. (2005). Introduction to psychological and physiological acoustics. New York: Marcel Dekker.
- Gullick, W.L. (1971). Hearing physiology and psychophysics. New York: Oxford University Press.).
- Howard, D and Angus, J (2013). Acoustics and Psychacoustics. Oxford: Taylor & Francis
- Moore, B. C. J. (1995). Hearing. San Diego: Academic Press.
- Stanley, A. Gelfand (1998). Hearing. New York: Marcel Dekker Inc.
- Stuart Rosen & Deter Howell (1991). Signals and systems for speech and hearing. CA: Academic Press Inc.
- Stuart Rosen and Deter Howell (1991). Signals and systems for speech and hearing. CA: Academic Press Inc
- Yost, W. A. (1994). Fundamentals of hearing: An introduction. San Diego: Academic Press.
- Zwicker, E., &Fastl, H. (1999). Psychoacoustics-Facts and models. Springer Verlag: Berlin Heidelberg.

Semester II

AUD 201: Neurophysiology of Hearing

60 hours: 100 marks

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

a) explain the anatomy afferent system,
b) describe the neurophysiology of hearing,
c) explain the efferent auditory system,
d) describe the functioning and role of efferent system,
e) understand the neurophysiological basis of the disorders affecting the auditory nervous system, and
f) understand the basis of electrophysiological assessment

Unit 1: Ascending Auditory Pathway: Anatomy

a) Auditory nerve
b) Cochlear nucleus
c) Superior olivary complex
d) Lateral leminiscus
e) Inferior colliculus
f) Medial geniculate body

Unit 2: Functioning of the Auditory Nerve

a) Stimulus coding
    i. Frequency, intensity and temporal coding
    ii. Coding of complex signals
b) Non linearity
c) Action potentials
d) Neurotransmitters and neuromodulators

Unit 3: Physiology of Auditory Brainstem

a) Tonotopic organization of auditory brainstem
    i. Cochlear nucleus
    ii. Superior olivary complex
    iii. Lateral lemniscus
    iv. Inferior colliculus
    v. Medial Geniculate body
b) Coding of simple and complex acoustic signals at auditory brainstem
    i. Cochlear nucleus
    ii. Superior olivary complex
    iii. Lateral lemniscus
    iv. Inferior colliculus
    v. Medial Geniculate body
c) Role of subcortical structures in sound localization

Unit 4: Anatomy and Physiology of Auditory Cortex

a) Anatomy of primary and secondary auditory cortex
b) Tonotopic organization in auditory cortex
c) Coding of signals in the at auditory cortex
   i. Simple and complex signals
   ii. Speech
d) Association of auditory cortex with other structures
e) Role of auditory cortex in sound localization
f) Plasticity of auditory cortex

Unit 5: Efferent Auditory System

a) Efferent auditory pathway: medial and lateral olivo cochlear bundle
b) Functioning of the auditory efferent system
c) Role of auditory efferent system in hearing
d) Protective function of auditory efferent system

Recommended Reading

- Aitkin, L. (1990). The auditory cortex: structural and functional bases of auditory perception. University of Michigen: Chapman and Hall.
- Berlin, C.E. (1999). The efferent auditory system: basic science and clinical applications. USA: Singular Publishing Group.
- Enrique A. & Lopez-Poveda,S. (2010). The neurophysiological bases of auditory perception. New York: Springer -Verlag.
- Gelfand, S.A. (2004). Hearing: An introduction to psychological and physiological acoustics. USA: Marcel Dekker Inc.
- Günter, E., &Romand, R. (1997). The central auditory system. United Kingdom: Oxford University Press.
- Jahn, A.F., & Santos-Sacchi J. (2001). Physiology of the ear. San Diego: Singular/Thomson Learning.
- Jeffery, A., & Schreiner, C. (2005). The inferior Colliculus. USA: Springer-Verlag.
- Lambert, M.S., Miriam T. T, & Susan F. M (2010). Superior Olivary Complex. USA: Betascript Publishers.
- Meddis,R.(2010). Computational Models of the Auditory System. USA: Springer-Verlag.
- Moore, D., Rees, A. & Palmer, A.R. (2010). Oxford handbook of auditory science the ear. United Kingdom: Oxford University Press.
- Musiek, F.E., &Baran, J.A. (2006). The auditory system: anatomy, physiology and clinical correlates. USA: Indiana University Press.
- Musiek, F.E., Baran, J.A., Shinn, J., & Raleigh, J. (2012). Disorders of the Auditory System. San Diego: Plural Publishers.
- Pickels, J.O. (2012). An introduction to the physiology of hearing. United Kingdom: Emerald Group Publishing Inc.
- Richard, A. (1991). Neurobiology of Hearing. USA: Raven Press.
- Ryugo, D.K. (2010). Auditory and Vestibular Efferents. USA: Springer-Verlag.
- Schnupp, J., Nelken, I., & Andrew, K (2011). Auditory Neuroscience: Making Sense of Sound. USA: Library of Congress.

- Steven, G., & William, A.A. (2006). Listening to Speech: auditory perspectives. New

Jersey: Lawrence Erlbaum Associates

- Syka, J., &Merzenich, M.M. (2003). Plasticity and signal representation in the auditory system. USA: Springer Science.
- Tony, L. S., Richard, H. N., &Musiek, F.E. (1997). Efferent auditory system: structure and function. USA: Singular Publishing Group.
- Webster, D.B., Popper A.N., & Fay R.R. (1992). The Mammalian auditory pathway: neuroanatomy. New York: Springer-Verlag.

AUD 202: Auditory Perception

Marks -100: Hours - 60

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

a) understand the processes involved in the perception of speech by persons with normal and impaired hearing, and apply principles of speech perception in therapy and research.

Unit 1: Temporal processing

a) Overview of temporal processing: temporal resolution; temporal integration; models of temporal processing
b) Detection and discrimination of gaps in normals and individuals with hearing impairment
c) Temporal modulation transfer function in normals and individuals with hearing impairment
d) Temporal integration in persons with normal hearing and those with hearing impairment
e) Models of temporal processing in persons with normal hearing and those with hearing impairment

Unit 2: Auditory object and pattern perception

a) Basic concepts in auditory object perception
b) Spectral cues for object perception
c) Temporal cues for object perception
d) Auditory pattern perception in individuals with normal hearing and those with hearing impairment
e) Timber perception
f) Time invariant-pattern and time varying pattern perception

Unit 3: Adaptation

a) Adaptation vs. fatigue
b) Methods of studying adaptation
c) Adaptation in in persons with normal hearing and those with hearing impairment
d) Neurophysiological basis of adaptation
e) Factors affecting adaptation

Unit 4: Perception in Space

a) Perception of distance: localization vs. lateralization; localization of pure tones; localization of complex signals
b) Effect of hearing loss on localization
c) Monaural localization
d) Factors affecting localization
e) Neurophysiology of localization

Unit 5: Binaural hearing and Perception of Music

a) Binaural hearing - overview
b) Models of binaural hearing
c) Masking level difference
d) Musical scales/Musical notes
e) Factors affecting perception of music

Recommended Reading

- Brain, C.J. Moore (1986). Frequency selectivity in Hearing. CA: Academic Press Inc.
- Diana Deutsch (2013). The Psychology of Music, Third Edition (Cognition and Perception) 3rd Edition. Academic Press
- Gelfand, S, A. (2005). Introduction to psychological and physiological acoustics. New York: Marcel Dekker.
- Howard, D and Angus, J (2013). Acoustics and Psychacoustics. Oxford: Taylor & Francis
- M. Riess Jones, R.R. Fay, A.N. Popper (2010). Music Perception. Springer
- Oxenham, A., & Bacon, S. (2003). Cochlear Compression: Perceptual Measures and Implications for Normal and Impaired Hearing. Ear and Hearing, 24, 350-366.
- Plack, C.J., Oxenham, A.J., & Fay, R.R. (2005). Pitch: Neural Coding and Perception. New York: Springer.
- Stanley, A. Gelfand (1998). Hearing. New York: Marcel Dekker Inc.
- Warren, R. M. (2008). Auditory Perception: An Analysis and Synthesis. Cambridge: Cambridge University Press.
- Yost, W. A. (1994). Fundamentals of hearing: An introduction. San Diego: Academic Press.
- Zwicker, E., &Fastl, H. (1999). Psychoacoustics-Facts and models. Springer: Verlag Berlin Heidelberg.

AUD 203: Auditory Disorders

Marks -100: Hours - 60

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

a) explain the pathophysiology of auditory disorders,
b) diagnose and differentially diagnose auditory disorders, and
c) recommendappropriate management options for the clients with hearing loss .

Unit 1: Disorders of the External and Middle Ear

a) Congenital malformations of external and middle ear
b) 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
c) Diseases of the middle ear cleft: otosclerosis otitis media, non suppurative otitis media, complications of middle ear diseases, neoplasms.
d) Assessment of middle ear functioning: multicomponent tympanometry, multifrequency tympanometry, wide band reflectance/absorbance, reflexometry
d) Reconstruction of external and middle ear hearing mechanisms: reconstructive and rehabilitation procedures

Unit 2: Disorders of the Cochlea

a) Pathophysiology inner ear disorders: ototoxicity, Meniere's, age related hearing loss, Sudden hearing loss, auto immune conditions, hearing loss due to systemic diseases
b) Audiological profile in persons with above inner ear disorders
c) Nonaudiolgical management options

Unit 3: Disorders of the Cochlea– NIHL &Traumatic Injury

a) Pathophysiology inner ear disorders due toNIHL and other traumatic injuries
b) Audiological profile in persons with NIHL and other traumatic injuries
c) Hearing conservation: National and International guidelines
d) Nonaudiolgical management options

Unit 4: Auditory Nerve and Brainstem

a) Pathophysiology of space occupying lesions of auditory nerve and brainstem
b) Audiological profile in persons with space occupying lesions
d) Radiological findings and its correlations with audiological findings
d) Challenges in diagnosis of space occupying lesion
e) Management options for space occupying lesion

Unit 5: Auditory Neuropathy Spectrum Disorders

a) Pathophysiology of ANSD
b) Etiology of ANSD
c) Audiological profile of persons with ANSD and its correlations with pathophysiology

d) Speech perception in persons with ANSD
e) Management of persons with ANSD: Aids strategies

Recommended Reading

- Berlin, C. I., Hood, L. J., & Ricci, A. (2002). Hair Cell Micromechanics and Otoacoustic Emissions. New York: Thomson Learning Inc.
- Chasin, M (2009) Hearing Loss in Musicians: Prevention and Management. San Diego: Plural Publishers
- Hall, J. W. (2000). Handbook of Otoacoustic Emissions. San Diego: Singular Publishing Company.
- Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson.
- Hood, L.J. (1998). Clinical applications of auditory brainstem response. San Diego: Singular Publishing Group Inc.
- Moller, A. R. (2000). Hearing: Its physiology and pathology. San Diego: Academic Press.
- Rintleman, W.F. (1991). Hearing Assessment. Boston: Allyn and Bacon.
- Roeser, R. J., Valente, M., & Hosford-Dunn, H. (2007). Audiology: Diagnosis. New York: Thieme Medical Publishers.
- Sanbridge, S.A. (2009). Ear Disorders. San Diego: Plural Publishers
- Sininger, Y& Starr, A (2001). Auditory Neuropathy: A new perspective in hearing disorders
- Standring, S. (2008). Gray's Anatomy: The Anatomical Basis of Clinical Practice, Expert Consult. Livigstone: Churchill publishers.
- Wiley, T.L., & Fowler, C.G. (1997). Acoustic immittance measures in clinical audiology: A primer. San Diego: Singular Publishing Group Inc.

AUD 204 : Electrophysiological Assessment

60 hours: 100 marks

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

a) describe and classify auditory evoked potentials,
b) understand the technology for recording auditory evoked potentials,
c) record and interpret exogenous and endogenous potentials,
d) use appropriate protocols for recording exogenous and endogenous potentials for clinical and research purposes, and
e) understand research needs in auditory evoked potentials

Unit 1: Foundations of Auditory Evoked Potentials (AEPs)

a) Introduction and Classification of AEPs
b) Neuroanatomy and neurophysiology related to AEPs; dipole orientation and scalp distribution of AEPs
c) Stimuli for recording AEPs- generation, characteristics and types
d) Electrodes for recording AEPs
e) General principles of recording AEPs
f) Overview to advanced analyses techniques such as independent component and time frequency analyses
g) Maintenance and Calibration of instrumentation

Unit 2: Auditory Brainstem Responses

a) Acquisition and analysis responses for different stimuli -clicks, tone buursts, chirps, complex stimuli such as speech
b) New trends in ABR such as Cochlear Hydrops Analysis Masker Procedure (CHAMP) and stacked ABRs, and ABR for chained stimuli,
c) Factors influencing ABR: Stimuli related, acquisition related, subject related
d) Clinical applications

Unit 3: Middle Latency Auditory Evoked Potentials and Auditory Steady State Responses

a) Acquisition and analysis of middle latency responses,
b) Factors influencing middle latency responses: Stimuli related, acquisition related, subject related
c) Acquisition and analysis of auditory steady state responses (ASSR)
d) Factors influencing ASSR: Stimuli related, acquisition related, subject related
e) Post auricular muscle responses
f) Clinical applications

Unit 4: Cortical Auditory Evoked Potentials

a) Overview of exogenous and endogenous cortical evoked potentials
b) Acquisition and analysis of obligatory cortical auditory evoked potentials, acoustic change complex, T-complex, mismatch negativity, P300, N400, P600, CNV and other endogenous potentials
c) Factors affecting exogenous and endogenous evoked potentials Stimuli related, acquisition related, subject related
d) Clinical applications

Unit 5: Intraoperative monitoring

a) Physiological tests useful in intraoperative monitoring of auditory function
b) Effect of anesthetic agents on electrophysiological responses of the auditory system
c) Recording auditory evoked potentials during surgery; requirements, patient preparation
d) Guidelines for intraoperative monitoring
e) Electroneurenography

Recommended Reading

- Burkard, R.F., Don, M., &Eggermont, J.J. (Eds.) (2007). Auditory Evoked Potentials: Basic Principles & Applications. Baltimore: Lippincott Williams & Wilkins.
- Ferraro, J.A. (1997). Laboratory exercises in auditory evoked potentials. San Diego: Singular Publishing Group Inc.
- Hall, J.W. (1992). Handbook of Auditory Evoked Responses. Massachussetts: Allyn and Bacon.
- Hall, J.W. (2007). New Handbook of Auditory Evoked Responses. Boston: Pearson.
- Hall, J.W., & Mueller, H.G. (1997) Audiologists' Desk Reference. Volume 1: Diagnostic Audiology Principles, Procedures and Protocols. San Diego: Singular Publishing Group.
- Hood, L.J. (1998). Clinical applications of auditory brainstem response. San Diego: Singular Publishing Group Inc.
- Katz, J. (Ed.). (1994). Handbook of Clinical Audiology. Baltimore: Williams and Wilkins.
- Kilney, P.R. (2017). Audiologists handbook of intraoperative neurophysiological monitoring. San Diego: Plural Publishing Group
- McPherson, L.D. (1995). Late potentials of the auditory system. London: Singular Publishing Group.
- Picton, T. (2010). Human Auditory Evoked Potentials. San Diego: Plural Publishing Group.
- Rance, G (2008). Auditory Steady State Responses. San Diego: Plural Publishing Group

AUD 105 & AUD 205: Clinicals in Audiology

General considerations:

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

Know-how

a) Make appropriate changes in OAE protocols depending on the clinical / research needs
b) Develop protocol for recording exogenous and endogenous auditory evoked potentials
d) Integrate the results of audiological evaluation and correlate it to the possible pathophysiological/radiological findings
e) Apply the latest technological advances available for persons with hearing impairment.
f) Make appropriate modifications in hearing devices depending on the listening needs.
g) Recommend appropriate aural rehabilitation program for persons with hearing impairment

Demonstrate

a) Recording of exogenous and endogenous potentials
b) Generation of stimuli for recording AEPs
c) Analyze auditory evoked potential waveforms
d) Electroacoustic measurement of different types of hearing aids
e) Carry out ear mold modifications

Do

a) Record OAEs, ABR for different stimuli and cortical auditory potentials on 5 persons with hearing loss
b) Complete audiological evaluation on 5 persons with hearing loss and prepare a detailed report with appropriate recommendations
c) Select and fit appropriate hearing devices to 10 individuals with different degree, configuration and type of hearing loss.
d) Plan and carry out appropriate aural rehabilitation program for five children
e) Evaluate and counsel/carry out appropriate audiological management for 5 persons with tinnitus.
f) Carry out aided AEPs

Evaluation

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

Semester III

AUD 301 : Auditory Processing Disorders

60 hours: 100 marks

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

a) diagnose and differentially diagnose auditory processing disorders (APDs) and explain their physiological bases,
b) administer different tests for diagnosis and interpret the findings including correlation with findings from imaging and cognitive studies,
c) institute screening and public education programs in different setups on APDs,
d) identify and explain factors influencing assessment of APDs,
e) advise clinical clientele on management of APDS including guidance on aids and appliances, and
f) advise and liaise with members of the management team like neurologists, neurosurgeons on the diagnosis as well as management of APDs.

Unit 1: Introduction to Auditory Processing Disorders (APDs)

a) Terminologies and definitions of APD
b) Underlying neurobilogical and neurochemical (genetic) correlates
c) Relationship between neural maturation - degeneration and auditory processing
d) Models to explain auditory and spoken language processing:
e) Relationship between the two Methods of studying auditory processing - Animal studies
d) Various disorders that lead to APDs (Syndromes, TBIetc): Signs, symptoms and classification
e) Developmental communication disorders and APDs

Unit 2: Assessment of APDs (Behavioral)

a) Overview of behavioral assessment in APDs
b) Screening for APDs: questionnaires, checklists and tests
c) Dichotic test (linguistic and non-linguistic)
d) Monaural tests (linguistic and non-linguistic)
e) Psychoacoustic tests for assessment of APDs

Unit 3: Assessment of APDs (Electrophysiological)

a) Electrophysiological measures and their clinical applications in diagnosing APDs
    i. Endogenous potentials
    ii. Exogenous potentials
b) Correlation between behavioral and electrophysiological measures: implications for diagnosis
c) Factors influencing assessment of APDs: behavioral and electrophysiological

Unit 4: Management of APDs

a) Management of APDs in children and adults
b) Direct remediation techniques and meta-cognitive and meta-linguistic approaches

c) Auditory perceptual training and its methods, applicability and outcome.
d) Evidence based approach and treatment efficacy
e) Multidisciplinary approach
f) Signal enhancement and room acoustics
g) Aids and appliances - indication and outcome
h) Factors affecting management of APDs

Unit 5: Team work in the diagnosis and management of APDs

a) Electrophysiological and radiological correlates for APDs: implications in management
b) Imaging and cognitive studies in APDs
c) Diagnosis and differential diagnosis
d) Development of APD test materials (linguistic and non-linguistic)
e) Open source software for developing diagnostic tests and intervention modules

Recommended Reading

- American Speech-Language-Hearing Association. (2005). (Central) auditory processing disorder (technical report) Retrieved from http://www.asha.org/ members/desref-journals/deskref/ default..
- Geffner, D., & Ross-Swain, D. (2013). Auditory Processing Disorders: Assessment, Management, and Treatment. 2nd Edn. San Diego, Plural Publishing Inc.
- Musiek, F. E., Baran, J. A., Shinn, J. B., & Jones, R. O. (2012). Disorders of the Auditory System. San Diego: Plural Publishing Inc
- Musiek, F. E., &Chermak, G. D. (2014). Handbook Of Central Auditory Processing Disorder: Auditory Neuroscience And Diagnosis. 2nd Edn, Vol: 1. San Diego: Plural Publishing Group Inc.
- Chermak, G. D., &Musiek, F. E. (2006). Handbook of (Central) Auditory Processing Disorders – Comprehensive Intervention. Vol. II. San Diego: Singular Publishing Group Inc.
- Chermak, G. D., &Musiek, F. E. (2002). Auditory Training: Principles and Approaches for Remediating and Managing Auditory Processing Disorders. Seminars In Hearing, 23(4),297-308

AUD 302: Advances in the Management of Hearing Loss

Hours - 60 : Marks - 100

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

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

Unit 1: Advances in Hearing Aid and Hearing Assistive Technology

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

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

a) Selection, verification and validation of hearing aids and hearing assistive devices: Pre-selection, selection an assessment of listening needs
b) Objective procedures for hearing aid fitting (ABR, ALLR, ASSR and others):
c) Hearing aid programming, optimization, verification and validation
d) Hearing aid fitting for children : pre-selection, selection, verification and validation: Different protocols used
e) Hearing aid fitting for persons with different types of hearing loss (Sudden hearing loss, unilateral hearing loss, High frequency hearing loss, Cochlear dead region)
f) Future trends in hearing aids and HATs: Technology and fitting strategies

Unit 3: Speech Perception Through Hearing Aids

a) Factors affecting speech perception through hearing aids and hearing devices: Auditory plasticity
b) Methods to improve speech perception through hearing aids and hearing devices: Speech cue enhancement – spectral shape, duration, intensity, enhancement of CVR, speech simplification, re-synthesis, enhancement of perception of telephone speech
c) Emerging technology for better speech perception
d) Noise reduction algorithms and nanotechnology in hearing aids

Unit 4: Rehabilitation of Individuals with Hearing Impairment

a) Counseling of users of hearing aid and hearing assistive devices: techniques: Realistic expectations, adjusting to hearing device, other management options
b) Care and maintenance of hearing aid and hearing assistive devices
c) Trouble shooting and fine tuning/optimization of hearing aids and assistive devices
d) Management of children with hearing impairment: Criteria for selecting different auditory listening programs; criteria for transition from one method to the other as a child grows:
   Adapting AVT techniques for Indian languages and late identified children
e) Providing group listening training activities for children having different listening skills
f) Rehabilitation of adults and older adults: auditory listening / speech reading training for older adults: variables that affect the communication and the role of the communication partner: auditory plasticity: Planning training activities; assertiveness training
g) Quality of life of hearing impaired and its enhancement: Outcomes of different management strategies across age groups: Methods and measures

Unit 5: Management of the children/adult with Multiple Disabilities and other Hearing Related Disorders

a) Management of children and adults with multiply disability: 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: educational and vocational placement, role of caregivers and outcome measures
b) Audiological management of tinnitus: characteristics, assessment of tinnitus, basis and theories of tinnitus, models related to tinnitus management: patho-physiological and neurophysiological model: overview to non-audiological management techniques for tinnitus
c) Audiological management techniques for those with normal hearing and different degrees of hearing loss (TRT, counseling, others) and their outcomes
d) Audiological management of persons with hyperacusis: Models related to hyperacusis management; overview to non-audiological management techniques for hyperacusis Audiological management techniques for normal hearing and different degrees of hearing loss and their outcomes

Recommended Reading

- Atcherson, S. R., Franklin, C. A., & Smith-Olinde, L. (2015). Hearing assistive and access technology. San Diego: Plural Publishing Inc.
- Dillon, H. (2012). Hearing Aids. 2nd Edn. Australia: Boomerang Press.
- Martini, A., Mazzoli, M., Read, A., & Stephens, D. (2001). Definitions, Protocols and Guidelines in Genetic Hearing Impairment. England: Whurr Publishers Ltd.
- Metz, M. J. (2014). Sandlin's textbook of hearing aid amplification. 3rd Edn. San Diego: Plural publishing Inc.
- Schaub, A. (2008). Digital hearing aids. New York: Thieme Medical publishers.
- Mueller, H. G., Rickettes, T. A., &Bentler, R. (2014). Modern hearing aids: Pre-fitting Testing and selection considerations. San Diego: Plural Publishing Inc.

- Sandlin, R.E. (1995). Handbook of Hearing aid amplification – clinical consideration and fitting practices. London: Singular Publishing Group.
- Tyler, R.S., &Schum, J. (1995). Assistive devices for persons with hearing impairment. United States of America: Allyn&Baccon.
- Cole, E.B., & Carol, F. (2007).Children with hearing loss- Developing Listening & Talking. United States of America: Plural Publishing Inc.
- Estabrooks, W. (2006). Auditory Verbal Therapy & Practice. United States: Alexander Graham Bell Association for the Deaf and Hard of Hearing Inc.
- Hull, R. H. (2014). Introduction to aural rehabilitation. 2nd edn. San Diego: Plural publishing Inc.
- Tye-Murray, N. (2015). Foundations of aural rehabilitation-Children, Adults & Their family members. 4th Edn. United States of America: Stamford, Cengage Learning.
- Baguley, D. M., &Andersson, G. (2007). Hyperacusis: Mechanisms, Diagnosis and Therapies. San Diego: Plural Publishing Inc.
- Hersh, M. A., & Johnson, M. A. (2003). Assistive Technology for the hearing-impaired, Deaf and Deaf-blind. Nottingham: Springer-Verlag London Ltd.
- Jastreboff, P.J., &Hazell, J.W.P. (2004). Tinnitus retraining therapy-implementing the Neurophysiological model. United Kingdom: Cambridge University Press.
- Johnson, C. E. (2012). Introduction to auditory rehabilitation: A contemporary issues approach. New Jersy: Pearson Education, Inc.
- Wong, L., &Hickson, L. (2012). Evidence-based practice in audiology: Evalauting interventions for children and adults with hearing impairment. San Diego: Plural Publishing Inc.

AUD 303: Speech Perception

Marks -100: Hours - 60

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

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

Unit 1: Theories of Speech Perception

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

Unit 2: Perceptual Cues for Vowels and Consonants

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

Unit 3: Speech Perception of Segmental and Suprasegmental Features

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

Unit 4: Factors related to Speech Perception

a) Memory and speech perception: Stages of memory, coding and capacity at the different stages; Models of short term memory: Dual coding Model, Modal model, A model for auditory memory and contrast, Working memory model; Role of short term memory in the perception of consonants and vowels
b) Dichotic listening: Theories and physiological bases: Testing of dichotic listening and the clinical significance of the results; Factors influencing dichotic perception
c) Music perception: Methods of study of perception of music; Perception of music through amplification and implantable devices.

Unit 5: General issues related to speech perception

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

Recommended Reading

- Raphael, L. J., Borden,G. J.,& Harris K. S. (2011). Speech Science Primer: Physiology, Acoustics, and Perception of Speech (Sixth edition). Baltimore, MD: LWW.
- Greenberg, S., Ainsworth, W. A., & Fay, R. R. (Eds.).(2004). Speech Processing in the Auditory System. New York: Springer.
- Mildner, V. (2007).The Cognitive Neuroscience of Human Communication (1 edition). New York: Psychology Press.
- Pickett, J. M. (1998). The Acoustics of Speech Communication: Fundamentals, Speech Perception Theory, and Technology (1 edition). Boston: Pearson
- Pisoni, D. B., &Remez, R. E. (Eds.). (2005). The Handbook of Speech Perception. Blackwell Publishing Ltd.
- Studdert-Kennedy, M., & Mattingly, I. G. (Eds.). (1990). Modularity and the Motor theory of Speech Perception: Proceedings of A Conference ToHonor Alvin M. Liberman (1 edition). Hillsdale, N.J: Psychology Press.
- Sanders, D.A (1977).Auditory perception of speech - an introduction to principle and problems. New Jersey: Prentice Hall
- Tatham, M., & Morton, K. (2011).A Guide to Speech Production and Perception (1 edition). Edinburgh: Edinburgh University Press
- Kent, R. D. (2002). Acoustic Analysis of Speech (2nd Revised edition edition). Australia *;* United States: Delmar Cengage Learning.

AUD 304(a):Genetics of Hearing and Pediatric Audiology

Hours - 60 : Marks - 100

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

a) understand the genetic basis for hearing loss
b) understand the tests/procedures for identifying genes for hearing loss
c) counsel parents or caregivers of children with genetic and non-genetic hearing loss
d) carry out screening programs to identify hearing loss using appropriate protocols, and
e) diagnose and manage hearing loss in children using appropriate tests/protocols and aural management procedures

Unit 1: Molecular Genetics for Audiologists

a) Basic concepts of genetics
b) Genes involved in hearing
c) Gene localization methods, gene mapping

Unit 2: Genetic Hearing Loss

a) Genetics of hearing impairment, gene database for hearing loss
b) Genetic evaluation of persons/families with hearing loss, genetic screening
c) Genotypes and phenotypes of non syndromic hearing loss
d) Genotypes and phenotypes of syndromic hearing loss
e) Genetic counseling

Unit 3: Hearing Screening

a) Neonatal and infant hearing screening, international and national Protocols to identify middle ear disorders; sensory and neural hearing loss
b) Screening for hearing loss in school children
c) Screening for central auditory processing disorders in school children
d) Issues related to hearing screening

Unit 4: Pediatric Hearing Evaluation

a) Etiology of hearing loss in children
b) Behavioral tests of hearing evaluation for children
c) Physiological tests of hearing evaluation for children
d) Assessing hearing in children with associated problems
e) Speech audiometry in children
f) Development of tests for speech audiometry in children
g) Issues related to assessment and diagnosis of hearing loss in children

Unit 5: Team Approach in diagnosis of hearing loss in children

a) Integration of results of behavioral and electrophysiological assessment of hearing
b) Correlating results of audiological evaluation with those of otolaryngological, pediatric, psychological and speech-language evaluation
c) Problems faced by children with hearing loss in preschool and school setup
d) Challenges/problems faced by children with conductive hearing loss and auditory processing problems
e) Counseling parents/caregivers regarding hearing impairment, sequel and management
f) Counseling and management of children with unilateral hearing loss and mild hearing loss

Recommended Reading

- Bess, F.H. & Gravel, J.S. (2006). Foundations of Pediatric Audiology. San Diego: Plural Publishing Inc
- Driscoll, C. & McPherson, B (2010). Newborn Screening Systems: The complete perspective. San Diego: Plural Publishing Inc
- Martini, A, et al.(1996) Genetics and Hearing impairment, London: Whurr Publishers.
- McCreery, R.W. & Walker, E.A. (2017). Pediatric Amplification: Enhancing Auditory Access. San Diego: Plural Publishing Inc
- Northern, J. L. & Downs, M. P. (2014). Hearing in Children. San Diego: Plural Publishing Inc
- Shprintzen, R.J. (1997). Genetic, Syndromes and communication disorders. San Diego: Singular Publishing Group Inc.
- Willems P J. (2004). Genetic Hearing loss. USA: Marcel Deckeer Inc.
- Tharpe, A.M. &Seewald, R. (2016). Comprehensive Handbook of Pediatric Audiology.San Diego: Plural Publishing Inc
- Toriello H V.,& Smith S D. (2013).Hereditary Hearing Loss and Its Syndromes. United Kingdom: Oxford University Press.
- Flexer C A (2008).Pediatric Audiology: Diagnosis, Technology, and Management. New York: Thieme Medical Publishers.

AUD 304(b): Age related changes in Audio-Vestibular System

Hours - 60 : Marks - 100

Objectives:

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

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

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

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

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

1.3 Peripheral vestibular system
- Semi-circular canals
- Otolith organs (Utricle & Saccule

1.4 Age at which maturation is attained and age at which decline commences for:
- Conductive mechanism
- Cochlea
- Peripheral vestibular system

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

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: Effect of age on behavioural auditory and vestibular responses

3.1 Tests of auditory function

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

3.2 Tests for vestibular function

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

Unit 4: Effect of age on physiological responses of auditory systems

Physiological assessment of auditory system

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

4.1 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}.

Unit 5: Effect of age on physiological responses of vestibular systems

4.2 Vestibular electrophysiological changes

- Vestibular evoked myogenic potentials
  - Cervical VEMP
  - Ocular VEMP
- Oculomotor evaluation
  - Gaze test
  - Optokinetic test
  - Smooth pursuit test
  - Saccade test
- Positional and positioning test
- Video head impulse test
- Bithermal caloric test
- Computerized dynamic posturography
- Rotary chair test

PRACTICUM:

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

References:

- Armstrong, D., Stoney, P., Hawke, M., & Farkashidy, J. (1992). Presbycusis: correlations of clinical audiology with morphological changes in the cochlea and the ventral cochlear nucleus. *Journal of Otolaryngology*, 21(5), 343-349.
- Goldberg, J., Buettner-Ennever, J. A., & Fukushima, K. (2007). The vestibular system. Oxford: Oxford University Press.
- **Gordon-Salant, S., Frisina, R. D., Fay, R. R., & Popper, A. (2010). The Aging Auditory System (Springer Handbook of Auditory Research). New York: Springer-Verlag.**
- Highstein, S., Fay, R., & Popper, A. (2003). The vestibular system. New York: Springer Publishers.
- Hughes, G. B., & Pensak, M. L. (2007). Clinical otology. New York: Theime Medical Publishers.
- Merchant, S. N., Velazquez-Villasenor, L., Tsuji, K., Glynn, R. J., Wall, C3., & Rauch, S. D. (2000). Temporal bone studies of the human peripheral vestibular system. Normative vestibular hair cell data, *Annals of Otology Rhinology and Laryngology Supplement* 181, 3-13.
- Nelson, E. G., & Hinojosa, R. (2003). Presbycusis: A human temporal bone study of individuals with flat audiometric patterns of hearing loss using a new method to quantify stria vascularis volume. *The Laryngoscope*, 113(10), 1672-1686.
- Nelson, E. G., & Hinojosa, R. (2006). Presbycusis: A human temporal bone study of individuals with downward sloping audiometric patterns of hearing loss and review of the literature. *The Laryngoscope*. 116 (9 Pt 3 Supplement 112), 1-12.
- Ohlemiller, K. K., & Gagnon, P. M. (2004). Apical-to-basal gradients in age-related cochlear degeneration and their relationship to "primary" loss of cochlear neurons. *Journal of Comparative Neurology*, 479(1), 103-116.
- Poeppel, D., Overath, T., & Popper, A. N. (2012). The Human Auditory Cortex. New York: Springer Publishers.
- Romand, R., & Varela-Niet, I. (2003). Development of Auditory and Vestibular Systems-3. New York: Academic Press.
- Rubel, E. W., & Fay, R. R. (2012). The development of the auditory system. New York: Springer Publishers.
- Ryugo, D. K., Fay, R. R., & Popper, A. N. (2010). Auditory and vestibular efferents. New York: Springer Publishers.
- Sandara, G., Frisinia, R., Fay, R., & Popper, A. (2010). The aging auditory system. New York: Springer Publishers.

- Terao, K., Cureoglu, S., Schachern, P. A., Morita, N., Nomiya, S., Deroee, A. F., Doi, K., Mori, K., Murata, K., & Paparella, M. M. (2011). Cochlear changes in presbycusis with tinnitus. *American Journal of Otolaryngology*, 32(3), 215-220.
- Velazquez-Villasenor, L., Merchant, S. N., Tsuji, K., Glynn, R. J., Wall C3., & Rauch, S. D. (2000). Temporal bone studies of the human peripheral vestibular system. Normative Scarpa's ganglion cell data. *Annals of Otology Rhinology and Laryngology Supplement* 181, 14-19.
- Weinstein, B. E. (2000). Geriatric Audiology. New York: Theime Medical Publishers.
- Werner, L., Fay, R. R., & Popper, A. N. (2012). Human Auditory Development. New York: Springer Publishers.
- Chen, B., Zhong, Y., Peng, W., Sun, Y., & Kong, W. J. (2010). Age-related changes in the central auditory system: comparison of D-galactose-induced aging rats and naturally aging rats. *Brain Research*, 1344, 43-53.
- Frisina, R. D., & Walton, J. P. (2006). Age-related structural and functional changes in the cochlear nucleus. *Hearing Research*, 16(217), 216-23.
- Goldberg, J. Buettner-Ennever, J. A., Fukushima, K. (2007). The Vestibular System. Oxford University Press.
- Gordon-Salant, S., Frisina, R. D., Fay, R. R., & Popper, A. (2010). The Aging Auditory System (Springer Handbook of Auditory Research). New York: Springer-Verlag.
- Hinojosa, R., & Nelson, E. G. (2011). Cochlear nucleus neuron analysis in individuals with presbycusis. *The Laryngoscope*, 121(12), 2641-2648.
- Hughes, G. B., & Pensak, M. L. (2007). Clinical otology. Theime Publishers.
- Makary, C. A., Shin. J., Kujawa, S. G., Liberman, M. C., & Merchant, S. N. (2011). Age-related primary cochlear neuronal degeneration in human temporal bones. *Journal of the Association for Research in Otolaryngology,* 12(6), 711-717.
- Ohlemiller, K. K., & Gagnon, P. M. (2004). Apical-to-basal gradients in age-related cochlear degeneration and their relationship to "primary" loss of cochlear neurons. *Journal of Comparative Neurology*, 479(1), 103-16.
- Poeppel, D., Overath, T., & Popper, A. N. (2012). The human auditory cortex. New York: Springer Publishers.
- Romand, R., & Varela-Niet, I. (2003). Development of auditory and vestibular systems-3. Academic Press.
- Rubel, E. W., & Fay, R. R. (2012). The development of the auditory system. New York: Springer Publishers.
- Ryugo, D. K., Fay, R. R., & Popper, A. N. (2010). Auditory and vestibular efferents. New York: Springer Publishers.
- Sandara, G., Frisinia, R., Fay, R., & Popper, A. (2010). The aging auditory system. New York: Springer Publishers.
- Shim, H. J., Lee, L. H., Huh, Y., Lee, S. Y., & Yeo, S. G. (2012). Age-related changes in the expression of NMDA, serotonin, and GAD in the central auditory system of the rat. *Acta Otolaryngologica,* 132(1), 44-50.
- Weinstein, B. A. (2000). Geriatric Audiology. Theime Medical Publishers.
- Werner, L., Fay, R. R., & Popper, A. N. (2012). Human Auditory Development. New York: Springer Publishers.

- Amos, N. E., & Humes, L. E. (2007). Contribution of high frequencies to speech recognition in quiet and noise in listeners with varying degrees of high-frequency sensori-neural hearing loss. *Journal of Speech Language and Hearing Research*, 50, 819-834.
- Burk, M. H., & Humes, L. E. (2008). Effects of long-term training on aided speech-recognition performance in noise in older adults. *Journal of Speech Language and Hearing Research*, 51, 759-771.
- Burk, M. H., Humes, L. E., Amos, N. E., & Strauser, L. E. (2006). Effect of training on word-recognition performance in noise for young normal-hearing and older hearing-impaired listeners. *Ear and Hearing*, 27, 263-278.
- Committee on Hearing, Bioacoustics, and Biomechanics (CHABA) (1988). Speech understanding and aging. *Journal of the Acoustical Society of America*, 83, 859-895.
- Cooper, J. C. Jr., & Gates, G. A. (1991). Hearing in the elderly-the Framingham cohort, 1983–1985: Part II. Prevalence of central auditory processing disorders. *Ear and Hearing*, 12, 304-311.
- Divenyi, P. L., & Haupt, K. M. (1997). Audiological correlates of speech understanding in elderly listeners with mild-to-moderate hearing loss. II. Correlational analysis. *Ear and Hearing*, 18, 100-113.
- Divenyi, P. L., & Haupt, K. M. (1997). Audiological correlates of speech understanding in elderly listeners with mild-to-moderate hearing loss. III. Factor representation. *Ear and Hearing*, 18, 189-201.
- Dubno, J. R., Horwitz, A. R., & Ahlstrom, J. B. (2002). Benefit of modulated maskers for speech recognition by younger and older adults with normal hearing. *Journal of the Acoustical Society of America*, 111, 2897-2907.
- Dubno, J. R., Horwitz, A. R., & Ahlstrom, J. B. (2003). Recovery from prior stimulation: masking of speech by interrupted noise for younger and older adults with normal hearing. *Journal of the Acoustical Society of America*, 113, 2084-2094.
- George, E. L. J., Zekveld, A. A., Kramer, S. E., Goverts, S. T., Festen, J. M., & Houtgast, T. (2007). Auditory and nonauditory factors affecting speech reception in noise by older listeners. *Journal of the Acoustical Society of America*, 121, 2362-2375.
- **Gerber, S. E. (1996).** The handbook of pediatric audiology. Washington, DC: Galludet University Press.
- **Gordon-Salant, S., Frisina, R. D., Fay, R. R., & Popper, A. (2010). The Aging Auditory System (Springer Handbook of Auditory Research). New York: Springer-Verlag**
- **Madell, J. R., & Flexer, C. A. (2004).** Pediatric audiology: diagnosis, technology, and management. New York: Thieme Medical Publishers.
- **Madell, J., & Flexer, C. (2006).** Pediatric audiology casebook. New York: Thieme Medical Publishers.
- **McCormic, B. (1995).** The medical practitioner's guide to paediatric audiology. New York: Cambridge University Press.
- McCormick, B. (2004). Paediatirc audiology (0-5 years). London: Whurr Publishers
- Musiek, F. E., & Chermak, G. D. (2014). Handbook of central auditory processing disorders. Volume I: Auditory neuroscience and diagnosis. 2nd Ed. San Diego, CA: Plural Publishing Inc.
- **Newton, V. E. (2009).** Paediatric audiological medicine. London: Whurr Publishers.
- **Northern, J. L. & Downs, M. P. (2007).** Hearing in Children. Philadelphia Lippinkot: Williams and Willkins.

- Anderson, S., Parbery-Clark, A., Yi, H. G., & Kraus, N. (2011). A neural basis of speech-in-noise perception in older adults. *Ear and Hearing*, 32(6), 750-757.
- Burkard, R. F., Eggermont, J. J., & Don, M. (2006). Auditory evoked potentials: basic principles and *clinical* application. Lippinkot: Williams and Wilkins.
- **Gerber, S. E. (1996).** The Handbook of pediatric audiology. Washington, DC: Galludet University Press.
- Hall, J. W. (2010). New handbook for auditory evoked responses. Boson, MA: Allyn and Bacon
- Harris, K. C., Mills, J. H., He, N. J., & Dubno, J. R. (2008). Age-related differences in sensitivity to small changes in frequency assessed with cortical evoked potentials. *Hearing Research*, 243(1-2), 47-56.
- Katz, Burkard, J. R. F., & Medwetsky, L. (2010). Handbook of clinical audiology. Lippinkot: Williams and Wilkins.
- Konrad-Martin, D., Dille, M. F., McMillan, G., Griest, S., McDermott, D., Fausti, S. A., & Austin, D. F. (2012). Age related changes in the auditory brainstem response. *Journal of the American Academy of Audiology*, 23(1), 18-35.
- Musiek, F. E., & Chermak, G. D. (2014). Handbook of central auditory processing disorders. Volume I: Auditory neuroscience and diagnosis. 2nd Ed. San Diego, CA: Plural Publishing Inc.
- **Northern, J. L., & Downs, M. P. (2007).** Hearing in children. Philadelphia: Lippinkot: Williams and Willkins.
- Swartz, K. P., Walton, J. P., Hantz, E. C., Goldhammer, E., Crummer, G. C., & Frisina, R. D. (1994). P_3 event-related potentials and performance of young and old subjects for music perception tasks. International *Journal of Neuroscience*, 78(3-4), 223-239.
- Tremblay, K. L., Piskosz, M., & Souza, P. (2003). Effects of age and age-related hearing loss on the neural representation of speech cues. *Clinical Neurophysiology*, 114(7), 1332-1343.

Hours - 60 : Marks - 100

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

a) identify and describe the types of implantable hearing devices,
b) describe the purpose of different components of implantable hearing devices,
c) determine candidacy for implantable hearing devices,
d) assess benefits from implantable hearing devices and guide the clinical population, and
e) understand and contribute to formulation Government policies and schemes relating to implantable hearing devices

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

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

Unit2: Bone Conduction Implantable Devices and Middle Ear Implants

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

Unit 3: Cochlear Implants

a) Concepts and types of CI : external components (sound processor- body worn, BTE, off the ear); internal component (electrode type/design, MRI compatibility & reliability);totally implantable cochlear implants.
b) Expanding criteria- audiological and non-audiological assessment: single sided deafness, ski sloping SN hearing loss, bilateral asymmetric HL; cochlea/nerve anomaly(classification), auditory neuropathy spectrum disorder (ANSD) and multiple disabilities.
c) Speech/Sound Coding Strategies: Within and across devices; Evidences from research and critical analysis of each strategy; Features for Enhancing Speech and Music perception.
d) Surgical procedures: posterior tympanotomy, varia technique, hearing preservation technique; surgical complications and management

e) Intra-operative measurement: device function (impedance/ voltage/ complaince telemetry); patient function (eCAP, eSRT, eABR and facial nerve monitoring); Special consideration in anomalous cochlear/nerve, ANSD and multiple disabilities.

Unit 4: Programming Cochlear Implants

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

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

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

Recommended Reading

- Boheim, K. (2010). Active middle ear implants. Basel: Karger.
- Clark, G., (2003). Cochlear implants - fundamentals & Applications. New York: Springer – AIP Press.
- Cooper, H. (1995). Cochlear Implants –A practical guide. Delhi: AITBS Publishers.
- Hughes, M. L. (2013). Objective measures in cochlear implants. San Diego: Plural Publishing Inc.

- Kirwin, S.H. (2014). Cochlear Implants: Technological advances, psychological/social impacts and long-term effectiveness. Ney York: Nova Biomedical.
- Kompis, M., &Caversaccio, M.D. (Eds.). (2011). Implantable Bone Conduction Hearing Aids. (New Delhi) Switzerland: Karger.
- Lim, H. H., Lenarz, M., &Lenarz, T., (2009). Auditory midbrain implant: A review. Trends in Amplification, Sept. 13(3), 149–180.
- Manenkar, G. (2014). Implantable hearing devices other than cochlear implants. New D Suzuki, J.I, Tokyo (1988). Advances in audiology-Middle ear implant: Implantable hearing aids. Switzerland: Karger. Delhi: Springer-Verlag.
- Niparko, J. K. (2009). Cochlear Implants: Principles and practices. 2nd Edn. Philadelphia: Lippincott: Williams & Wilkins.
- Wolfe, J., & Schafer, E. C. (2010). Programming Cochlear Implants. San Diego: Plural Publishing Inc.

AUD 402 : Vestibular System and its Disorders

60 hours: 100 marks

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

a) describe the functioning of the balance and vestibular system
b) explain the disorders of the vestibular system
c) assess vestibular system using appropriate tests/protocols
d) recommend appropriate management option for persons with vestibular dysfunction
e) counsel and guide the clinical clientele with vestibular disorders on quality of life etc.

Unit 1: Anatomy and Physiology of the Vestibular System

a) Peripheral vestibular system including semicircular canals, utricle, saccule and vestibular nerve
b) Central vestibular pathway (brainstem, cerebellum, cortex)
c) Reflexes involving vestibular system like vestibuloocular reflex, vestibulo spinal reflex and vestibulo colic reflexadvise
d) Other systems involved in maintenance of balance like proprioceptive system, visual system etc.

Unit 2: Assessment of the Vestibular System

a) Techniques and Principles of electronystagmography / videonystagmography, Rotatory chair test, Video Head Impulse test, Sclera Coil search test, Vestibular Evoked Myogenic Potentials: cVEMP, oVEMP, Dynamic Posturography, Craniocorpography, Subjective visual vertical horizontal tests, Vestibular autorotation tests
b) Screening for vestibular disorders
c) Questionnaires to assess quality of life in persons with vertigo

Unit 3: Pathophysiology of Vestibular Disorders

a) Peripheral Vestibular Disorders like Benign paroxysmal positional vertigo, Meniere's disease, Vestibular neuritis, Labyrinthitis, Ototoxicity, vestibular neuropathy
b) Perilymph fistula, Superior semicircular canal dehiscence, Auditory neuropathy spectrum disorders, Vestibular schwannomas
c) Central Vestibular disorders like Generalized neuropathy involving multiple systems, Multiple sclerosis, Cranial tumors, Cerebro-vascular accidents involving vestibular cortex and cerebellum, Vertebro-basilar insufficiency, Migraine, Meningitis and encephalitis
d) Vestibular disorders in children
e) Age related changes in vestibular system

Unit 4: Profiling Vestibular Disorders using Audio Vestibular Test Battery

a) Benign paroxysmal positional vertigo, Meniere's disease, Vestibular neuritis, Labyrinthitis, Ototoxicity, Perilymph fistula, Superior semicircular canal dehiscence, Auditory neuropathy spectrum disorders, Vestibular schwannomas, Multiple sclerosis, Cranial tumors, , vestibular neuropathy
b) Quality of life in persons with vestibular disorders

Unit 5: Management of Persons with Vestibular Disorders

a) Medical management
b) Surgical management
c) Vestibular rehabilitation:
   i. Repositioning Maneuvers
   ii. Adaptation Exercises
   iii. Habituation Exercises
   iv. Imbalance Exercises
d) Special considerations for rehabilitation of children with vestibular problems
e) Vestibular implants

Recommended Reading

- Ackley, R. S., Decker, T. N., & Limb, C. J. (2007). An essential guide to hearing and balance disorders. New Jersey: Lawrence Erlbaum Associates Inc.
- Biswas, A. (2009). Clinical audio-vestibulometry for otologists and neurologists. 4th Ed. Mumbai, India: Bhalani Publishing House.
- Desmond, A. L. (2004). Vestibular function: evaluation and treatment. New York: Thieme Medical Publishers Inc.
- Hughes, G. B., &Pensak, M. L. (2007). Clinical Otology. New York: Thieme Publishers, Inc.
- Jackler, R. K., &Brackmann, D. E. (2005). Neurotology. 2nd Ed. Philadelphia: Elsevier Mosby.
- Jacobson, G. P., & Shepard, N. T. (2014). Balance function assessment and management. San Diego: CA: Plural Publishing Inc.
- Kaga, K. (2014). Vertigo and balance disorders in children. Tokyo, Japan: Springer.
- McCaslin, D. L. (2013). Electronystagmography and videonystagmographyENG / VNG. San Diego: Plural Publishing Inc.
- Murofushi, T., &Kaga, K. (2009). Vestibular evoked myogenic potential- its basics and clinical applications. Tokyo, Japan: Springer.
- Myers, B.L. (2011). Vestibular Learning Manual. San Diego: Plural Publishing Inc.
- O'Reille, R.C., Morlet,T&Kushing, S.L (2013). Manual of pediatric balance disorders. San Diego: Plural Publishing Inc.
- Ruckienstien, M & Davis, S. (2014). Rapid interpretation of balance function tests. San Diego: Plural Publishing Inc.
- Shepard, N. T., &Telian, S. A. (1997). Practical management of the balance disorders patient. New York: Thomson Delmar Learning.

AUD 403(a) : Audiology in Practice

Marks - 100 : Hours - 60

Objectives: At the end of the course, the students should be able

a) know the role of an audiologist in different set-ups.
b) liaise with other professionals in setting-up an audiologyclinic.
c) audit audiology practices in existing set-ups.
d) implement acts and legislations relating to persons with hearing impairment,
e) advise Governments and other agencies on the formulation of policies and legislative acts relating to hearing disability
f) understand the legal implications of practice in audiology.

Unit 1: Scope of Practice, Laws, Regulations and Professional Ethics

a) Scope of practice in global and Indian scenario
b) Professional ethics
c) Existing acts, legislations, policies related to persons with communication impairment
d) Role of audiologist in the formulation of acts, regulations and policies
e) Implementation of acts, legislations, policies and welfare measures relating to persons with hearing impairment
f) Advocacy groups and rights of citizens
g) National and international standards related to audiology
h) Welfare measures provided by State and Central Government for persons with hearing impairment

Unit 2: Specialized Programs in Audiology

a) Need for specialized programs in audiology: Geriatric and persons with multiple disability
b) Forensic audiology
d) Health, wellness, and health care - Health promotion and disease prevention, quality of life and healthcare finances
e) Disability-friendly environment including public education
f) Prevention and early identification programs including societal participation

Unit 3: Service Delivery Models in Audiology

a) Services in different medical / rehabilitation/ research /educational set ups
b) School based services pertaining to regular and special schools
c) Community based practice in rural and urban areas
d) Family empowerment programs
e) Home based delivery of services
f) Autonomous practice in audiology
g) Apps for hearing screening/assessment

Unit 4: Tele-practice in Audiology

a) Information and communication technology in Audiology practice
b) Infrastructure for video-conferencing and tele-practice in audiology
c) Techniques/principles of remote testing for screening and diagnostic assessment for hearing, intervention and counseling
d) Challenges and limitations of tele-practice in audiology in screening, assessment and evaluation, selection of aids and appliances, therapeutics and counseling.

Unit 5: Issues in Audiology Practice

a) Medico-legal issues,
b) Entrepreneurship and planning to set up private practice/clinic for audiology practice: Clinical ethics
b) Documentation in audiology practice: clinical / demographic data, database management and storage
c) ICF framework for documentation / reports
d) Quality control and auditing in audiology practice
e) Documenting and implementing evidence based practice in audiology
f) Understanding team approach: Work in cohesion with other professionals
g) Information resources in audiology including books and journals, both electronic and print - Databases

Recommended Reading

- College of Audiologists and Speech-Language Pathologists of Ontario.(2004). Use of Telepractice Approaches in Providing Services to Patients/Clients.
- Dobie, R.A (2015). Medico legal evaluation of hearing loss. San Diego: Plural Publishing Inc
- Dunn, H.H., Roeser, R.J., & Valente, M. (2000).Audiology- practice management. New York: Thieme Medical Publishers Inc.
- King, P.F. et al., (1993). Assessment of hearing disability- guidelines for medico-legal practice, London: Whurr Publishers.
- Ramachandran,V&Stach, B.A. (2013). Professional Communication Audiology. San Diego: Plural Publishing Inc
- Resource Guide for Educational/Pediatric Audiologists. Retrieved from http://www.asha.org/aud/pediatric-ed
- Rizzo, S.R., &Trudean, M.D. (1994).Clinical administration in audiology and speech language pathology. San Diego: Singular Publishing Group Inc.
- Rushbrooks, E & Houston, K.T. (2015).Telepractice in Audiology. San Diego: Plural Publishing
- Stephen, R.R., Jr., Trudeau, D.M. (Eds.) (1994). Clinical administration in audiology & speech language pathology. San Diego: Singular Publishing Group Inc.
- Taylor, B. (2015). Marketing in an Audiology practice.San Diego: CA: Plural Publishing Inc.
- www.rehabcouncil.nic.in (website of Rehabilitation Council of India)
- www.disabilityaffairs.gov.in (website of Department of Empowerment with Disabilities
- Acts relating to disability, particularly hearing, enacted by the Indian Parliament.

AUD 403(b) : Clinical Counselling

Marks - 100 : Hours - 60

Objectives:

After successful completion of the course student will be

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

Unit 1: Introduction

- Guidance and Counseling: Meaning, Nature, Scope, Principles and Goals
- Types and Techniques: Individual and group with special focus on need and applications of clinical counseling
- 1.3Counseling across life span: Child, Adolescent, Parenthood, Sibling, Grandparent/Elderly;Counseling across Relationships: Teacher, family and peer Group
- 1.4Portrait of Effective Counselors: Qualifications and Qualities, Micro and macro skills and competencies; Do's and Don'ts; Expectations and Limitations in Professional Clinical Counseling; Tips for Improvement; Ethical Issues

Unit 2: Counselor process

- Counseling Process: Stages in Clinical Counseling
- Preparation and Pre-requisites: Middle Phase, Termination
- Therapeutic Relationships
- Principles in Clinical Practice: Directive and Non-Directive approaches
- Tools for Clinical Counseling
- Major Events (Transference, Counter Transference & Resistance)

Unit 3: Special areas

- Special Areas in clinical counseling: Counseling the differently abled, parents, sibling and grandparents and significant others
- Counseling: Crisis counseling, gender counseling, human rights,
- Enablement and empowerment through counseling
- Counseling the elderly & psychiatric patients

Unit 4: Introduction to Behavior

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

Unit 2: Behavior assessment & management

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

Practicum:

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

Reference:

- Gelso, C.J., & Fretz, B.R. (1995). *Counseling Psychology*. New Delhi: A Prism Indian Edition.
- Hansen, J.C., Stevic, R.R., & Warner, R.W. (1987). *Counseling*. Boston: Allyn & Bacon, Inc.,
- Nelson-Jones, R. (1999). *Introduction to Counseling Skills*. London: Sage Publications.
- Rao, N.S. (1981). *Counseling Psychology*. New Delhi: Tata McGraw Hill Pub. Co.
- Palmer, S., Dainow, S., & Milner, P. (1996). *Counseling*. London, Sage Pubs.
- Shertzer, B.S., & Stone, B. (1968). *Fundamentals of Counseling*. NY: Houghton Mifflin Co.
- Neukrug, E. (2015). The world of counselor: an introduction to counseling profession. Boston: Cengage Learning.
- Capuzzi, D., & Gross, D.R. (Eds.). (2013). Introduction to counseling program. New York: Routledge.
- Street, E. (1994). *Counselling for Family Problems*. London, Sage Publications.
- Blackham, G.J. (1977). Counselling – Theory, Process & Practice. Belmont: Wadsworth.

- Palmer, S. (1999). *Introduction to Counselling and Psychotherapy*. London: Sage Publications.
- Corey, G. (2011). Theory and practice of group counselling. 8th Edition. California: Brooks/Cole Publishing Company.
- Corey, G. (2001). *The art of integrative counselling.* Pacific Grove, CA: Brooks/Cole.
- *Gladding, S.T. (2009). Counselling: a comprehensive profession. New Delhi: Dorling Kindersley (India) Limited.*
- *Corey, G. (2013). Student manual for Corey's theory and practice of counselling and psychotherapy. Boston: Cengage Learning.*
- Nelson-Jones, R. (1982). *The Theory and Practice of Counselling Psychology*. London: Holt, Rinehart and Wilson.
- Corey, G. (2008). Theory and practice of counselling and psychotherapy. California: Brooks/Cole.
- Corey, G., Corey, C., & Corey, M.S. (2008). Groups: Process and Practice. California: Brooks/Cole.
- *Woolfe, R., Strawbridge, S., Douglas, B., & Dryden, W. (2010). Handbook of counselling psychology. New Delhi: Sage Publications.*
- *Daley, D.C., & Zuckoff, A. (1999). Improving treatment compliance: counselling and systems strategies for substance abuse and dual disorders. Minesota: Hazelden.*
- *Welfel, E.R. (2004). The counselling process: a multi-theoretical integrative approach. Pacific Grove, CA: Thomas/Brooks/Cole.*
- *Bradly, L.J., & Ladany, N. (2001). Counsellor supervision: principles, process, and practice. Philadelphia: Brunner-Routledge.*
- Jacobs, Ed. E., Masson, R.L., & Harvill, R.L. (1998). *Group Counselling: Strategies & Skills*. Pacific grove, CA: Books/Cole Pub. Co.,
- Madden, G.R. (1998). *Legal Issues in Social Work: Counselling and Mental Health*. Thousand Oaks: Sage.
- Thomas, R.M. (1990). *Counselling and Life-span development*. New Delhi: Sage.
- Tudor, K. (1998). *Group Counselling*. London: Sage.
- *Hart, JT (1983). Modern eclectic therapy a functional orientation to counselling and psychotherapy. New York: Plenum.*
- *Maki, D.R., & Tarvydas, V.M. (2011). The professional practice of rehabilitation counselling. New York: Springer.*
- *Toporek, L., Gerstein, L., Fouad, N., Roysircar, G., & Isreal, T. (2006). Handbook of social justice in counselling psychology. New Delhi: Sage.*
- *Gazda, G.M. (1989). Group Counselling. Boston: Allyn & Bacon.*
- *Ivey, A.E. (1998). Intentional interviewing and counselling: facilitating client development in a multicultural society. New York: Wadsworth.*
- Street, E. (1994). *Counselling for Family Problems*. London, Sage Publications.
- Blackham, G.J. (1977). Counselling – Theory, Process & Practice. Belmont: Wadsworth.

- Palmer, S. (1999). *Introduction to Counselling and Psychotherapy*. London: Sage Publications.

- Corey, G. (2011). Theory and practice of group counselling. 8th Edition. California: Brooks/Cole Publishing Company.
- Corey, G. (2001). *The art of integrative counselling.* Pacific Grove, CA: Brooks/Cole.
- *Gladding, S.T. (2009). Counselling: a comprehensive profession. New Delhi: Dorling Kindersley (India) Limited.*
- *Corey, G. (2013). Student manual for Corey's theory and practice of counselling and psychotherapy. Boston: Cengage Learning.*
- Nelson-Jones, R. (1982). *The Theory and Practice of Counselling Psychology*. London: Holt, Rinehart and Wilson.
- Corey, G. (2008). Theory and practice of counselling and psychotherapy. California: Brooks/Cole.
- Corey, G., Corey, C., & Corey, M.S. (2008). Groups: Process and Practice. California: Brooks/Cole.
- *Woolfe, R., Strawbridge, S., Douglas, B., & Dryden, W. (2010). Handbook of counselling psychology. New Delhi: Sage Publications.*
- *Daley, D.C., & Zuckoff, A. (1999). Improving treatment compliance: counselling and systems strategies for substance abuse and dual disorders. Minesota: Hazelden.*
- *Welfel, E.R. (2004). The counselling process: a multi-theoretical integrative approach. Pacific Grove, CA: Thomas/Brooks/Cole.*
- *Bradly, L.J., & Ladany, N. (2001). Counsellor supervision: principles, process, and practice. Philadelphia: Brunner-Routledge.*
- Jacobs, Ed. E., Masson, R.L., & Harvill, R.L. (1998). *Group Counselling: Strategies & Skills*. Pacific grove, CA: Books/Cole Pub. Co.,
- Madden, G.R. (1998). *Legal Issues in Social Work: Counselling and Mental Health*. Thousand Oaks: Sage.
- Thomas, R.M. (1990). *Counselling and Life-span development*. New Delhi: Sage.
- Tudor, K. (1998). *Group Counselling*. London: Sage.
- *Hart, JT (1983). Modern eclectic therapy a functional orientation to counselling and psychotherapy. New York: Plenum.*
- *Maki, D.R., & Tarvydas, V.M. (2011). The professional practice of rehabilitation counselling. New York: Springer.*
- *Toporek, L., Gerstein, L., Fouad, N., Roysircar, G., & Isreal, T. (2006). Handbook of social justice in counselling psychology. New Delhi: Sage.*
- *Gazda, G.M. (1989). Group Counselling. Boston: Allyn & Bacon.*
- *Ivey, A.E. (1998). Intentional interviewing and counselling: facilitating client development in a multicultural society. New York: Wadsworth.*
- Feldman, M.P., & Broadhurst, A. (1976).*Theoretical and experimental bases of the behavior therapy*. London: Wiley.
- Housten, R.V., & Axelrod, S. (1993). *Behavior analysis and treatment*. New York: Springer.
- Kearney, A.J. (2007). *Understanding Applied Behavior Analysis: An Introduction.* London: Jessica Kingsley.
- Malott, R., Tillema, M., & Glenn, S. (1978). *Behavior analysis and behavior modification: an introduction*. Kalamazoo, MI: Behaviordelia.
- Hersen, M. (2005). *Encyclopedia of behavior modification and Cognitive behavior therapy.* California: Sage Publications.

- Bellack, S. (1985). *International handbook of behavior modification and therapy.* New York: Plenum Press.
- Venkatesan, S. (2004). *Children with Developmental Disabilities: a training guide for parents, teachers and caregivers.* New Delhi: Sage.
- Peshawaria, R., & Venkatesan, S. (1992). *Behavior approach in teaching mentally retarded children: a manual for teachers.* Secunderabad: NIMH.
- Ramnero, J., & Törneke, N. (2008). *ABCs of human behavior: Behavioral principles for the practicing clinician.* Oakland, CA: New Harbinger & Reno, NV: Context Press.
- Miltenberger, R.G., (2008). *Behavior modification: Principles and procedures (4th Ed.)*. Pacific Grove, CA: Thomson/Wadsworth.
- Woods, D. W., & Kanter, J. W. (Eds.). (2007). *Understanding behavior disorders: A contemporary behavioral perspective*. Reno, NV: Context Press.
- Cooper, J.O., Heron, T.E. & Heward, W.L. (2007). *Applied Behavior Analysis (2nd Edition)*. Prentice Hall.
- Baum, W. M. (2004). *Understanding Behaviorism: Behavior, Culture, and Evolution (2nd edition)*. Wiley-Blackwell.
- Pierce, W.D. & Cheney, C.D. (2003). *Behavior Analysis and Learning, 3rd edition.* Lawrence Erlbaum.

General considerations

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

Know-how

a) Identify, manage and counsel persons with genetic hearing loss
b) Choose/modify appropriate tests/protocols for evaluating children and multiply disabled
c) Choose appropriate tests/protocols for evaluation and management of persons with giddiness
d) Develop language / culture sensitive APD tests
e) Advise clinical clientele on the latest implantable devices available for persons with hearing impairment.
f) Set up audiology clinics / centers in different set ups
g) Procedure for certification of persons with disability
h) Financial planning and insurance policies

Demonstrate

a) Administration of different tests for APD
b) Plan management for 5 persons with APD/at risk for APD
c) Administration of different tests for vestibular assessment
d) Troubleshoot cochlear implants

Do

a) Administer complete audiological test battery, behavioural and electrophysiological tests on 10 children with hearing loss and prepare a report explaining the results of the test and make appropriate recommendations
b) Administer APD test battery on 5 persons with APD symptoms and prepare a report
c) Administer complete vestibular test battery on 5 persons with giddiness
d) Carry out pre-implant counseling for 5 persons with hearing loss
e) Carry out mapping for 5 persons using cochlear implants
f) Counsel 5 persons regarding use and maintenance of cochlear implants

Evaluation

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