Residency Program
Doctor of Medicine (MD)
Curriculum (Phase-B)

Oncology

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Contents

1. Introduction:

1.1. Overview of the specialty:

The specialty of oncology developed as a specialization of physicians who are predominantly concerns with the care of patients with malignancy. It is a branch of medical science concerned with prevention, investigation and therapy of, and research into, any type of malignant condition. Care of the cancer patients embraces a wide range of clinical activities and oncologist need a broad view of caring of cancer patients and communities in which they live. This requires knowledge of not only the diagnostic and therapeutic modalities available, but also an appreciation of the importance of the epidemiology and potential for prevention of cancers.

Oncology is a highly practical skill based specialty with skill ness in radiation treatment planning and chemotherapy as a high profile components of the work load, competence in other areas of practice as radiobiological issues , oncopharmacology and tumor imaging are equally important. Indeed the expert clinical management of cancer patients with or without metastasis and complications is as rewarding as any other equipment based medical treatment.

Oncologists generally work as hospital based specialists and need to integrate their work with not only community based primary care colleagues but also other hospital based physicians. eg- Surgeons, Gynecologists, pathologists, medical physicists and the imaging specialties- radiology and nuclear medicine. Specialization within oncology become common place with individuals focusing the development of their expertise in area such as medical oncology, radiation oncology, haemato-oncology, pediatric oncology etc.

1.2. Program overview:

Introduction:

The following course curriculum has been designed to give the oncology student a professional curriculum that provides an excellent theoretical and practical background for a career as an oncologist. It will try to give a comprehensive knowledge of malignant diseases and their management through a multidisciplinary approach. As a multi-disciplinary tertiary care center BSMMU residency program will try to fulfill that goal of the country. As the undergraduate medical education curriculum has already undergone changes to match the modern medical education the postgraduate medical curriculum also need that change to be at per with modern medical world.

Purpose:

Oncology is a rapidly growing specialty, not only in the increased number of cancer patients, but in its knowledge base as well. In order to keep pace with the changing profile of health care delivery and still ensure uniform quality subspecialty training, a template for education is needed.

2. Design and Goals:

Goals of training were discussed and curriculum guidelines were created. The great expansion in knowledge related to cancer care has led to the development of this curriculum. The goals of this curriculum remain the same and emphasize formal instruction in the following:

1. The treatment of individual malignancies, with an emphasis on a coordinated multidisciplinary approach;
2. A clinical experience that emphasizes patient management in both the inpatient and outpatient settings;
3. The ability to perform specified procedures and
4. The key tools in basic science that apply to patient management.

This document should be considered the educational framework around which a training program is developed.

The Department of Clinical Oncology was founded in 1998 and name was changed to Department of Oncology in 2005 in accordance with the changed of University Organ gram.

The recent years have witnessed an explosion in medical technology. The pharmacopoeia of chemotherapeutic agents has grown from the three available agents in 1950 to over 100 anti neoplastic agents. Molecular diagnostic testing is now commonplace, and more widespread use of genetic screening is on the horizon. Moreover, an entirely new area of clinical research trials has been initiated in pharmacologic cancer prevention.

At the same time, health care has become an "industry" that has resulted in the shift of the majority of cancer care to the outpatient setting with a focus on cost-containment. It is a challenge to develop a curriculum for training physicians in so dynamic an environment.

While the BSMMU authority has create a basic structure for specialty training, the specific items that are to be included in the training curriculum are not within their purview. In this residency program, as already decided, 7 competencies are to be seen, they are, 1) Health advocacy, 2) Clinical expert, 3) Communication, 4) Professionalism, 5) Scholarship, 6) Collaborative and 7) Management. As per requirement of the RESIDENCY PROGRAM our department has thus taken on the task of creating a "Competence Comprising Curriculum" for oncology students which emphasizes formal instruction in the following:

I. Basic Scientific Principles; including cancer biology and genetics, cancer etiology, tumor immunology, and epidemiology.

II. Basic Principles in the Management and Treatment of Cancer; including pathology and laboratory medicine, radiology, surgical and radiation oncology, chemotherapy, biologic therapy and hormonal therapy.
III. Clinical Research; including design of clinical trails
IV. Cancer Types and Sites; Different cancer types and sites, in alphabetical order
V. Other Treatment Related Issues; including Oncological emergencies, paraneoplastic syndromes, bone marrow transplantation, local therapy of metastatic cancers, and management of malignant effusions.
VI. Complications; including infections and other complications of treatment
VII. Supportive Care; including pain management, hematopoietic growth factors, transfusion therapy, nutritional support, sexual problems, end-of-life care, complementary and alternative medicine, and unproven methods of treatment
VIII. Survivorship; including follow-up care at end of treatment, prevention of second malignancies, employment and insurance, information and education, and advocacy
IX. Psychological Aspects of Cancer; including psychological stages of cancer, cultural issues, spirituality, adaptive and maladaptive behavior, coping, and the use of psychotropic drugs
X. Bioethics, Legal and Economic Issues; including informed consent, research ethics, conflict of interest
XI. Communication Skills; including communication along the disease trajectory, delivering bad news, communication within the multidisciplinary team
XII. Procedures; including chemotherapy administration, tumor assessment, bone marrow aspiration, biopsy and interpretation

XIII. Information Systems in Oncology; including resources for patients and professionals, locating an oncologist, locating a clinical trial
XIV. Geriatric Oncology: including unique issues of cancer and aging, patient assessment, psychosocial implications.

The following curriculum should be considered as the educational framework for the training of resident physicians in the Department of Oncology.

3. Oncology Residency Phase B Program:

Residents will undertake a three year intensive phase B training after completion of phase A training in order to achieve the levels of knowledge, skills and expertise required for clinical practice in the field of oncology. It is a competency-based program emphasizing on meaningful integration and contextualization. The two years phase A training Program is designed to introduce and develop the broad range of core knowledge, skills, attitudes and behaviors required to become a competent physician. The knowledge and skills acquired during Phase A training are further focused and refined during Phase B training, which is a 3 (three) years Specialty-specific training in oncology.

The teaching, learning and assessments of the curriculum is facilitated by the provision of comprehensive, educationally oriented supervision and support, which is provided to all trainees across both the phases of the Program.

4. General Competency through Phase B:

Patient Care – Residents are supervised on inpatient rotations by full-time and clinical faculty, including a group of physicians of oncology department. Each patient is evaluated and reviewed with the resident. Residents work up patients

fully in both inpatient and outpatient settings and order diagnostic tests. They learn appropriate imaging tests, become familiar with various biopsy modalities and initiate therapy if needed under supervision.

Medical Knowledge - Residents are expected to demonstrate knowledge of oncology as assessed by supervising attending during formal rounds and during patient presentations, both on inpatient and outpatient services. Residents will be taught through patient-centered learning and supplemental reading and review of patient histopathological specimens in the Department of Pathology. Usual texts available in the department and main libraries as well as 24-hour access to Web-based Pub Med, Cancer Lit and Up To Date available. A knowledge-based end of rotation test is administered to each resident who rotates through the oncology service and a passing grade is required.

Practice-Based Learning - Emphasized during patient care encounters, in weekly oncology management conferences, and a cancer-screening program in continuity ambulatory care.

Interpersonal and Communication Skills - The ability to build and maintain patient relationships will be required of residents on all rotations. We will seek peer evaluation from fellow residents and written evaluation from staff working with the residents. Patient charts will be reviewed in a systematic way by attending physicians during the outpatient months to look at the quality of each resident's medical records. If the quality of the medical record is not acceptable, the resident will be given specific details on how to improve.

Professionalism - Each resident will be evaluated on the basis of his/her behavior with respect to honesty and compassion. Residents will be expected to treat patients in a manner which is sensitive to their culture, religion, gender and

sexual orientation. They will be expected to be nonjudgmental in their assessment of patients with problems of addiction. We will seek peer evaluation from fellow residents and written evaluation from staff working with the residents. This will take place on all rotations throughout the five years of residency.

System-Based Practice - Residents will be expected to keep a preventive medicine flow sheet on their patients to prompt scheduling of mammograms, colon cancer screening and Pap smears. Residents will be aware of Hospital based patient care and its services and know how to make a patient referral. Residents will be aware of inpatient living facilities for end-of-life care and the criteria for admission. Code status will be addressed and documented on all patients with a terminal illness.

Research Training - During their training, residents shall be required to complete an investigative project under faculty supervision. This may take the form of biological laboratory research, clinical research, medical physics research, or the retrospective analysis of data from treated patients. The results of such projects shall be suitable for publication in peer-reviewed scholarly journals or presentation at scientific meetings. Residents are expected to present their data to the department, during their training program. It is also expected that they will attempt to present the data at a scientific meeting. Most residents will work on these projects throughout the residency program, with more intensive work during their research rotation.

Evaluation - To ensure that you acquire adequate knowledge and develop your technical skills, your performance will be monitored carefully during the course of your residency. You will be formally evaluated by your supervising faculty member after each clinical rotation and on a quarterly basis by the allied health staff. In addition, you will regularly evaluate the

faculty, rotations, and the program to ensure that your educational needs are being met.

Career Development - Residents will meet periodically with various faculty members and the program director to discuss your professional goals. Thus, when you successfully complete the Oncology Residency Program, job opportunities may be available.

5. Discipline Competence:

The students after successful completion of their residency training should have:

1. Enough theoretical and practical knowledge for competent, safe, compassionate & ethical practice of oncology and should contribute to the future developments in oncology.
2. A detailed knowledge of the epidemiology, etiology, pathology a natural history of human neoplasm.
3. Considerable knowledge, experience & skill in the clinical diagnosis of human neoplastic diseases.
4. Considerable familiarity & skill in the application of all ancillary diagnostic aids in the diagnosis and management of cancer.
5. A high level of technical expertise in all forms of radiation as a therapeutic tool used in radiotherapy and knowledge of the adverse effects of radiation including radiation related accompaniments
6. Technical expertise and experience m the use of Cytotoxic agents
7. Familiarity with the role of surgery; in the management of neoplastic diseases
8. A sound capability to manage cancer patients as a whole
   a) The complications associated with malignant diseáse & ifs management
   b) Psychosocial problems
   c) Rehabilitation & palliative care

9. Capacity to interpret current advances in cancer management & research; (clinical, laboratory or basic).
10. A basic knowledge of the different statistical methods used in the interpretation of data related to cancer with special emphasis on planning & interpretation of clinical trials?
11. Attained a quality of specialty training, comparable to the best of standards where after obtaining MD (Oncology) the individual is competent to
    a) Provide best of care to cancer patients.
    b) Set up specialty department of Radiotherapy and Oncology in different parts of Bangladesh.
    c) Interact with the government machinery & other agencies as a nodal person for Department of Oncology .

6. Admission Requirements for Phase B Training:

A. Residents who has successfully completed phase A training and passed Phase A Final Examination are eligible for enrolment in the Phase B Program.

7. Educational Program:

7.1. Year plan:The training is designed to develop both the generic and specialty-specific attributes necessary to practice independently as Oncologist. The aim is to train individuals to provide the highest standard of service to patients with cancer. That includes the development of positive attitudes towards lifelong learning and the ability to adopt to future technological advances and the changing expectations of society. Academic year plan as follows :

□ Year - 01

- Competence based learning on Medical Oncology .
- Submission of Thesis Protocol.

- Knowledge on-
  1. Biostatistics
  2. Applied Immunology
  3. Genetics
  4. Cancer Epidemiology
  5. Applied Radiation Physics and Treatment Planning
  6. Medical Education

□ **Year – 02**

- Knowledge on oncologic allied subjects -
  - Psychiatry
  - Palliative and terminal care
  - Transfusion Medicine
  - ENT
  - Skin & VD
- Applied Radiation Physics and treatment planning
- Placement in NICRH/ DMCH for 3 months .
- Thesis works .

(Main focus on Radiation Oncology)

□ **Year - 03**

- Thesis Continued.
- Competence based learning on Radiation Therapy Machine Treatment
- Clinical Oncology continued and advanced treatment planning
- Final and Thesis examination.

7.2. Phase – B training rotation : Oncology specialty training comprises rotations in:

- Radiotherapy machine exposure.
- Treatment Planning Room
- Chemotherapy Day Care Center
- Tumor Board
- PET Scan Center
- Palliative care Center
- Oncology Subspecialties

8. Teaching and Learning Methods:

The bulk of learning occurs as a result of clinical experiences (experiential learning, on-the-job learning) and self-directed study. The degree of self-directed learning will increase as trainees became more experienced. Teaching and learning occurs using several methods that range from formal didactic lectures to planned clinical experiences. Aspects covered will include knowledge, skills and practices relevant to the discipline in order to achieve specific learning outcomes and competencies. The theoretical part of the curriculum presents the current body of knowledge necessary for practice. This can be imparted using lectures, grand teaching rounds, clinico-pathological meetings, morbidity/ mortality review meeting, literature reviews and presentations, journal clubs, self-directed learning, conferences and seminars.

9. Record of Training:

The evidence require to confirm progress through training includes:

- Details of the training rotations, the training plan agreed with weekly timetables and duty rosters; and numbers of practical procedures and outcomes
- Confirmations of attendance at events in the educational Program, at departmental and inter-departmental meetings and other educational events.
- Confirmation (certificates) of attendance at subject-based/skills-training/instructional courses
- Recorded attendance at conference and meetings.
- A properly completed logbook with entries capable of testifying to the training objectives which have been attained and the standard of performance achieved.
- CME activity.

- Supervisor's reports on Observed performance (in the workplace) of duties, practical procedures, of presentations made and teaching activity of advising and working with others, of standards of case notes, correspondence and communications with others.

9.1 Logbook :

Residents are required to maintain a logbook in which entries of academic/professional work done during the period of training should be made on daily basis and signed by the supervisor. Completed and duly certified logbook will form a part of the application for appearing in phase Final Examinations.

10. Research:

Development of research competencies forms an important part of the Residency Program curriculum as they are an essential set of skills for effective clinical practice undertaking research helps to develop critical thinking and the ability to review medical literature. Every Resident shall carry out work on an assigned research project under the guidance of a recognized supervisor, the project shall be written and submitted in the form of a thesis/ Research Report.

11. Assessment:

The assessment for certification of the MD degree of the University is comprehensive, integrated and phase-centered attempting to identify attributes expected of specialists for independent practice and lifelong learning and covers cognitive, psychomotor and affective domains. It keeps strict reference to the components, the contents, the competencies and the criteria laid down in the curriculum. Assessment includes both **Formative Assessment and Summative (Phase final) Examinations.**

11.1. Formative Assessment:

Formative assessment will be conducted throughout the training phases. It will be carried out for tracking the progress of residents, providing feedback, and preparing them for final assessment (Phase completion exams).

There will be Continuous (day-to-day) and Periodic type of formative assessment.

- **Continuous (day-to-day) formative assessment** in classroom and workplace settings provides guide to a resident's learning and a faculty's teaching / learning strategies to ensure formative lesson / training outcomes.
- **Periodic formative assessment** is quasi-formal and is directed to assessing the outcome of a **block placement** or **academic module completion**. It is held at the end of Block Placement and Academic Module Completion. The contents of such examinations include **Block Units** of the Training Curriculum and **Academic Module Units** of the Academic Curriculum.

11.1.1. End of Block Assessment (EBA):

End of Block Assessment (EBA) is a periodic formative assessment and is undertaken after completion of each training block, assessing knowledge, skills and attitude of the residents. Components of EBA are written examination, structured clinical Assessment (SCA), medical record review, and logbook assessment. Unsatisfactory block training must be satisfactorily completed to be eligible for phase final examination

11.1.2. Formative assessment for Academic modules for Biostatics and Research Methodology and Medical Education to be done in the first nine months of Phase B training. Residents getting unsatisfactory grade must achieve satisfactory grade by appearing the re-evaluation examination to be eligible for the Phase B Final Examination.

11.2. Summative Examination:

Assessment will be done in two broad compartments.

a) **Compartment A:** Consist of 3 (three) components.
   1. Written Examination (Consisting of 2 papers).
   2. Clinical Examination (One long and four short cases).
   3. SCA and Oral (10 stations SCA, Oral one board consisting of 2 examiners).

Every Resident must pass all the 3 components of compartment-A separately. Candidates will be declared failed if he/she fails in one or more component (s) of the examination. He/she then have to appear all the 3 components in the next Phase B Final Examination.

b) **Compartment B:** Thesis and Thesis defense.

11.2.1. Written Examination:

Two Papers: Contents of written papers listed in Annexure II

Question type and marks:

- Two Papers (Paper I and Paper II); 100 marks each; Time 3 hrs for each paper. Pass marks-60% of total of 2 papers.
- **Each paper will consist of Two Groups:**
- **Group A:**
  - 10 short questions (5 marks each)
  - These will assess the knowledge of different level and its application
- **Group B:**
  - 5 scenario based problem solving questions (10 marks for each).

  - The questions should focus to assess the capability of handling clinical problem independently and comprehensively as a specialist.
  - Suggested format:–
    - A scenario followed by question(s).
    - Questions may include diagnosis, differential diagnosis, investigation plan, treatment, follow up and patient education.

11.2.2. Clinical Examination: Long case and Short case:

- There will be one long case and four short cases.

i) **Long case: Marks-100**
   - Directly observed
   - Two examiners for each examinee.
   - History taking and examination by the examinee – 30min.
   - Discussion on the case 20 min.(presentation 6min, crossing 6x2min and decision 2min).
   - Examiners will not ask any question nor stop the examinee in any way during history taking and physical examinations.
   - Discussion should be done preferably as per structured format and proper weightage on different segments of clinical skills.

ii) **Short cases : Marks-100**
   - Four in number
   - Time 20-30 min. (Time will be equally divided for each short case)
   - Crossing should be done with proper weightage on different segment of clinical skills.

iii) **Pass marks: 60% of total of Long and Short Cases**

11.2.3. Structured Clinical Assessment (SCA): Marks-100

- 10 stations : 5 min each

11.2.4. Oral Examination: Marks-100

- One board consisting of 2 examiners.
- 20 minutes (9+9+2).

11.2.5. Pass marks in SCA and Oral: 60% of total (SCA and Oral.)

11.3 Thesis Evaluation:

- **Marks: Thesis writing-200; Defense-100: Marks for acceptane-60% of total.**

- To be evaluated by 3 (three) evaluators:- 2 subject specialists and one academician preferably involve in research and teaching research methodology.
- Among the subject specialists one should be external.
- Evaluators should be in the rank of Professor/Associate Professor.
- Supervisor will attend the defense as an observer and may interact only when requested by the evaluators.
- Thesis must be submitted to the controller of Exam not later than 27 months of enrolment in Phase-B.
- Thesis must be sent to the evaluators 2 (Two) weeks prior to assessment date.
- Evaluation will cover Thesis writing and its defense.
- For thesis writing evaluator will mark on its structure, content, flow, scientific value, cohesion, etc.
- For defense – Candidate is expected to defend, justify and relate the work and its findings.
- Assessment must be completed in next 3 months.
- Outcome of the assessment shall be in 4 categories – "Accepted", "Accepted with minor correction", "Accepted with major correction" and "Not Accepted".

11.3.1. Description of terms:

- **Accepted:** Assessors will sign the document and resident will bound it and submit to the Controller of Examinations by 10 days of the examination.
- **Accepted with minor correction:** Minor correction shall include small inclusion/exclusion of section; identified missing references, correction of references and

typographical and language problem. This should be corrected and submitted within 2 weeks.

- **Accepted with major correction:** Task is completed as per protocol with acceptable method but some re-analysis of result and corresponding discussion are to be modified.
- To be corrected, confirmed by Supervisor and submit within 3 (Three) weeks.
- **Not Accepted:** When work is not done as per protocol or method was faulty or require further inclusion or confirmation of study.
- To complete the suggested deficiencies and reappear in defense examination during its next Phase Final Examination.
- Candidate has to submit his/her thesis and sit for examination and pay usual examination fess for the examination.

11.3.2. Residents must submit and appear Thesis defense at notified date and time. However non- acceptance of the Thesis does not bar the resident in appearing the written, clinical and oral exam.

11.4. Qualifying for MD/MS Degree:

On passing both the compartments, the candidate will be conferred the degree of MD/MS in the respective discipline. If any candidate fails in one compartment he/she will appear in that compartment only in the subsequent Phase-B exam.

12. Supervision and Traninig Monitoring:

Training should incorporate the principle of gradually increasing responsibility, and provide each trainee with a sufficient scope, volume and variety of experience in a range of settings that include inpatients, outpatients, emergency and intensive care. All elements of work in training rotation must be supervised with the level of supervision varying depending on the experience of the trainee and the clinical exposure.

Outpatient and referral supervision must routinely include the opportunity to personally discuss all cases. As training progresses the trainee should have the opportunity for increasing autonomy, consistent with safe and effective care for the patient. Trainees will at all times have a named Supervisor, responsible for overseeing their education.

Supervisors are responsible for supervision of learning throughout the program to ensure patient and/ or laboratory safety, service delivery as well as the progress of the resident with learning and performance. They set the lesson plans based on the curriculum, undertake appraisal, review progress against the curriculum, give feedback on both formative and summative assessments as well as sign the logbook and portfolio. The residents are made aware of their limitation and are encouraged to seek advice and receive help at all times.

The Course Coordinator of each department coordinates all training and academic activities of the program in collaboration with the Course Manager. The Course Director of each faculty directs, guides and manages curricular activities under his/ her jurisdiction and is the person to be reported to for all events and performances of the residents and the supervisor.

13. Curriculum Implementation, Review and Updating:

Both Supervisors and Residents are expected to have a good knowledge of the curriculum and should use it as a guide for their training program. Sine Oncology has historically been rapidly changing specialty the need for review and up-dating of curricula is evident. The Curric ulum is specifically designed to guide an educational process and will continue to be the subject of active redrafting, to reflect changes in both Oncology and educational theory and practice. Residents and Supervisors are encouraged to discuss the curriculum and to feedback on content and issue regarding implementation at Residency Course Director. Review will be time tabled to occur

annually for any minor changes to the curriculum, The Curriculum will be reviewed with input from the various subspecialties of Oncology.

14. Specific Objectives and Syllabus:

14.1 Radiation Therapy Physics Objectives: The student will be able to-

1. Demonstrate knowledge of and ability to perform basic mathematical functions that apply to radiation therapy.
2. Discuss relative amounts of exposure from natural and artificial radiation sources
3. Define and describe the general principles relating to and the relationships between to mass and energy.
4. Discuss the relationship among types of energy.
5. Discuss and explain kinetic and potential energy and perform calculations involving conversion between potential and kinetic energy.
6. Define acceleration and velocity; solve related problems.
7. Identify the conditions necessary for the production of electromagnetic radiations.
8. Identify the characteristics of electromagnetic and particulate radiation.
9. Define frequency and wavelength and perform calculations involving them.
10. Identify and give the characteristics of elements, atoms and sub-atomic particles.
11. Describe atomic structure as defined by Bohr's theory. the nucleus and its contents orbital shells and their arrangement energy levels in the atom
12. Explain ionization.
13. Identify and define isotopes, isotones, isobars and isomers.
14. Define exposure and dose.
15. Discuss the measurement of radiation exposure and dose.

16. Define dose equivalence.
17. Define radioactivity and explain the specific processes involved.
18. Discuss the process of exponential decay and given the appropriate information, calculate exponential decay
19. Discuss the inverse square law and given the necessary information, perform calculations using this property.
20. Define and differentiate between the different photon interactions, and the predominant energy range for each.
21. Relate each photon interaction to its application in radiation therapy.
22. Describe the principles of particulate interactions.
23. Compare and contrast the beam energies and the dose rates for low energy and megavoltage units.
24. Discuss the protection necessary for proton, neutron and electron beams.
25. Define half-value layer and explaining its use in determining beam quality.
26. Compare and contrast Grenz, superficial and the orthovoltage units with regard to voltage, half-value layer and filtration.
27. Describe the design of various source housings for telecurie units.
28. Describe the operating principles of the betatron, van de graff and cyclotron.List and describe the components of a linear accelerator.
29. Describe photon and electron beam characteristics.
30. Contrast the depth dose data for various energies of linear accelerators.
31. Define beam energy characteristics.
32. Define Mayneord's f-factor and its relationship to tissue type and beam energy.

14.2 Simulation Techniques in Radiation Therapy
Objectives
The student will be able to-

1. List and describe various methods of tumor localization
2. Describe the principles of simulation
3. Identify the components and function of a simulator
4. State the purpose of simulator warm-up procedures
5. Describe the warm-up procedure for a simulator
6. State the location of emergency off switches
7. State patient support assembly functions and limits
8. Complete simulation data forms correctly
9. Describe various types of patient immobilization equipment
10. Describe the purpose and application of various immobilization devices
11. Demonstrate the use of the following patient positioning/immobilization devices:
12. Vac Lock Bag
13. Aquaplast
14. Taping
15. Belly board
16. Breast slant board
17. Wing board
18. Angle sponges
19. State the importance of skin marks
20. Describe the various methods of applying skin marks
21. List the advantages and disadvantages of various methods of skin marking
22. List the materials necessary to tattoo a patient
23. List and describe the various types of patient contour methods
24. Discuss the purpose of obtaining contours
25. Demonstrate ability to produce an accurate contour

26. Demonstrate knowledge of topographic anatomy pertinent to each body area discussed
27. Demonstrate knowledge of dose limiting structures pertinent to each body area discussed
28. State pertinent landmarks for setting field delineation for each body area discussed
29. Identify different types of immobilization necessary for each body area discussed
30. Demonstrate overall knowledge of simulation procedures for each body area discussed
31. Demonstrate accurate documentation of all field parameters set during each simulation procedure

14.3 Technical Radiation Oncology Objectives

The student will be able to:

1. Evaluate the scope of cancer and its impact on society
2. Recognize and understand the etiology and epidemiology of cancer
3. Apply prevention and education measures in addressing the cancer problem
4. Assess the statistical measures used in cancer and its management; incidence, examination, detection and screening.
5. Distinguish several varieties of abnormal growths
6. Define cancer as a pathological variation of normal growth
7. Define and differentiate various methods of classifying tumors
8. Categorize tumors into benign and malignant classes
9. Describe and differentiate between tumor and histopathological grading
10. List various factors involved in carcinogenesis and cellular differentiation
11. Distinguish between the management techniques for palliative, prophylactic and curative treatment

12. Identify patterns of failure in cancer management
13. List the types of conventional radiation units and describe their designs and uses
14. Describe the construction and operation of megavoltage teletherapy equipment, both linear accelerators and radioisotope units
15. Describe the construction, design and uses for stereotactic radiosurgery treatment units
16. Describe the construction, design and uses for intraoperative treatment units
17. Describe the construction, design and uses for heavy particle beam treatment units
18. Describe the construction, design and uses for radioisotope teletherapy treatment units
19. Describe the construction, design and uses for remote after loading brachytherapy treatment units
20. List and describe the half-life properties of radioisotope units
21. List and analyze various types of beam shaping and beam directing equipment
22. Describe the construction, types and operation of the patient support assembly
23. Describe the various means of patient immobilization
24. Evaluate the role of the radiation therapist in the use of ionizing radiation equipment and prescriptions

14.4 Clinical Oncology Objectives

The student will be able to:

1. Identify patients at risk for malignancy and counsel them regarding risk reduction and screening
2. Investigate clinical syndromes suggestive of underlying malignancy
3. Undertake the palliative care of patients with common solid and hematologic tumors

4. Identify neoplasm with a potential for cure and direct affected patients to the appropriate centers or providers
5. Participate in the difficult decisions regarding all aspects of management, including diagnostic evaluation and screening, treatment and palliative care
6. In addition, the resident learner must be familiar with the administration, side effects and drug interactions of therapeutic agents commonly used for the treatment of malignant disease
7. The detection of abnormal physical, laboratory, and radiologic findings relating to the lympho-haemopoietic system
8. The assessment of the need for bone marrow aspirate and biopsy and lymph node biopsy.
9. The initial diagnostic evaluation and management of the haemostatic and clotting system.
10. The assessment of the indications and procedure for transfusion of blood and its separate components
11. The management of therapeutic and prophylactic anticoagulation
12. The diagnosis and management of common anemia.
13. The pharmacology and use of common chemotherapies
14. The management of neutropenia / immunosuppression.

14.5 Syllabus:

□ BIOSTATISTICS

1. Introduction and basic definitions of Biostatistics
2. Measures of Central Tendency
3. Measures of Dispersion
4. Data presentations
5. Confidence Intervals
6. Population and Sampling
7. Normal distribution

8. Chi- sp (x2) Procedures
9. Regression and Correlation
10. Paired and Pulled T- Tests
11. Analysis of Variance
12. Tests of Significance
13. Screening
14. Chance and Null hypothesis
15. Study Designs
    - Cross sectional study
    - Longitudinal Study
    - Case Control Study
    - Control Study
    - Interventional Trials

□ IMMUNOLOGY :

1. Introduction Immunology
2. Basic immunology
3. Immunologic basis of Cancer Oncology and Cancer development
4. Malignant Transformation of cells
5. Cancer Immunotherapy
6. Cancer marker and antigens
7. Immunodeficiency diseases
8. Cancer Vaccines
9. Autoimmune disease and its relationship with cancer

□ GENETICS

1. Introduction To medical genetics
2. Mendalian principles of inheritance
3. Chromosome disorders
4. Single gene disorder
5. Prenatal diagnosis of genetic disease and counseling
6. Genetic basis of Cancer
7. Human genome project and gene Therapy
8. Ethical issues in medical genetics

9. Carrier detection
10. Risk calculation

□ CANCER EPIDEMIOLOGY

1. Introduction to cancer Epidemiology
2. Abnormality
3. Diagnosis
4. Measures of Occurrence of Disease and Other Health Related Events
5. Risk and casualty
6. Prognosis
7. Cancer Prevention
8. Cancer registry community based and hospital based registry
9. Role of Cancer Registry and International Classification of Disease for Oncology.

□ APPLIED RADIATION PHYSICS

1.1. Principles of Treatment Planning -1:

ICRU 50 and NACP terminologies. Determination of body contour and localization: Plain film,

Fluoroscopy, CT, MRI, Ultrasonography.

Simulator based Methods of for beam's oblique incidence, correction

and body in-homogeneities, SSD technique and iso-centric SAD} technique: Descriptions and advantages of SAD technique,

Combination of fields: Methods of field addition, Parallel opposed fields, Patient thickens vs. Dose uniformity for different energies in a parallel opposed setup, Multiple fields (3 fields, 4 field box and other techniques). Examples of above arrangements of fields in SSD and SAD techniques, Integral Dose.

Wedge field technique, Rotation Therapy (Arc, and Skip), Tangential fields. Beam balancing by weighting. Total and hemi-body irradiation. Field junctions. Principles of treatment planning-II

Limitations of manual planning, Description of a treatment planning system (IPS): 2D and 3D IPS Beam data input, Patient data input (simple contour, CT, MRI data, Advantages of transfer through media), Input devices (Digitizer, floppies, DAT devices, Magneto-optical disks, direct link with CT, MRI). Beam selection and placement, Beam's Eye View (BEV), Dose calculation and display {Point dose, Isodose curves. isodose surfaces, Color wash), Plan optimization.Plan evaluation tools: Dose-Volume Histograms (Cumulative and Differential), Hard copy output, Storage and retrieval of plans.

Alignment and Immobilization: External and internal reference marks, Importance of Immobilization in radiotherapy, Immobilization methods (Plaster of Paris casts, Perspex casts, bite block, shells, head rests, neck rolls, Alpha-Cradles, Thermoplastic materials, polyurethane foams), Methods of beam alignment (isocentric marks, laser marks, and front/back pointers).

Treatment execution: Light field, Cross hair. GDIs, Scales in treatment machine.

Treatment verification: Port films, Electronic portal imaging devices, In-vivo patient dosimetry (TLD, diode detectors, MOSFET, Film, etc Changes in patient position, target volume, and critical volume during course of treatment.

Electron Beam Therapy

Production of electron beams: Production using accelerators, Characteristics of electrons. Surface dose, percentage depth dose, beam profiles, Iso-dose curves and charts, Flatness and Symmetry, Beam collimation, variation of percentage depth dose and output with field size, and SSD, photon contamination. Energy spectrum, Energy specification, variation of mean energy with depth. Suitability of measuring instruments for electron beam dosimetry.

Treatment Planning: Energy and field size choice, air gaps, and obliquity, Tissue in-homogeneity-lung, bone, air filled

cavities. Field junctions (with either electron or photon beam).External and internal shielding. Arc therapy, Use of bolus in electron beam.
Total Skin Electron Irradiation, Intra-operative Radiation Therapy.

Brachytherapy:
Properties of an ideal brachytherapy source, Sources used in brachytherapy: Ra-226, Cs-137, Ir-192, Au-198. Co-60\ 1-125, Sr-90, Yt-90, Ru-106, Ta-132 and other new radionuclide, Their complete physical properties, Radium hazards. Source construction including filtration, comparative advantages of these radio nuclides.
Historical background, Radiation and Dose units: Activity used, Exposure, Absorbed Dose, mg-hr, curie, mili-curie destroyed, milligram Radium equivalent, roentgen, rad, gray. Source strength specification, Brachytherapy Dose calibrator.

Techniques: Pre-loading, After-loading (manual and remote), Merits and Demerits. Surface, Interstitial, Intra-cavitary, Intra-luminal, Intra-vascular brachytherapy. Low, Medium, High and pulsed dose raises, Remote after-loading machines, detailed description of any one unit.

Dosage systems: Manchester System (outline only), Pans System (working knowledge) Treatment planning; Patient selection, Volume specification, Geometry Number, Strength and Distribution of radioactive sources, Source local, calculation, Dose rate specification, Record keeping. ICRU 38.

Radiation Safety: Planning of brachytherapy facility, Rooms and equipments, and Movement control, Source inventory, Disposal, Regulatory requirements, Beta-ray brachytherapy including methods of use, inspection, storage and sources, dose distribution.

Unsealed radio nuclides: Concepts of uptake, distribution and elimination used in clinical practice, Estimation of dose to target tissues, and critical Procedures for administering radio nuclides to patients.

1.1.1. Quality Assurance in radiotherapy (QART)
Overview of ESTRO QART: Need for a quality system in Radiotherapy, Quality safety Definition and practical advantages, Construction, Development and implementation of a Quality system Quality Assurance of Simulator, TPS, Co-60, linear accelerator Acceptance testing of Simulator.

1.1.2. Radiation Protection and Regulatory Aspects:
Statutory Framework - Principles underlying International Commission on Radiation Protection (ICRP) recommendations. ICRP and National radiation protection i.e. Bangladesh Atomic Energy Commission standards. Effective dose limits (ICRP and AEC)
Protection mechanism: Time. Distance and Shielding. Concept of "As Low As Reasonably Achievable" (ALARA) Personnel and Area Monitoring: Need for personnel monitoring, Principles of film badge. TLD badge used for personnel monitoring, Pocket dosimeter. Need for area monitoring. Gamma Zone monitors, Survey meters.

Regularly aspects: Procedural steps for installation and commissioning of a radiotherapy facility (Teletherapy and Brachytherapy).Approval of Standing Committee on Radioth erapy Development Program.Type approval of unit. Site plan, Layout installation / Associated facility: Primary, Secondary barriers, leakage and scattered radiation. Regulatory requirement in procurement of teletherapy/brachytherapy; source(s). Construction of building. Qualified staff, Procurement of instruments, and accessories, Installation of

unit and performance tests, Calibration of unit, RP&AD approval for clinical commissioning of the unit.
Other regularity requirements.

1.1.3. Advancements in Radiation Oncology: 5 Lectures
Virtual Simulation; Principle, CT-Simulation, TPS based virtual simulation, Differences, Merits and Dements, Practical considerations.
Conforms! radiotherapy (CRT): Principles, Advantages over conventional methods, Essential requirements for conformal radiotherapy.
Fully customized field shaping using conventional coplanar beams
Multiple non-coplanar MLC beams conforming to target shape stereotactic radiotherapy
Principle of Inverse planning and Intensity
Modulated Radiation Therapy (IMRT) using 3D compensators
Static IMRT (Step and shoot technique)
Dynamic IMRT (sliding window technique)
Dynamic arc IMRT
Micro-MLC
Tomotherapy methods.

1.1.4. Time gated (4D) radiotherapy Merits and Dements of IMRT Stereotactic irradiation methods:
Physics principles, techniques, description of Units (Gamma Knife and Linac based), Merits and demerits, Stereotactic Radio-Surgery (SRS) and Stereotactic Radiotherapy (SRT), Whole Body Stereotactic Frame.

Networking in radiotherapy: Networking of planning and treatment units in a radiotherapy including Picture Archival Communication System (PACS), Advantages Patient Data Management.

1.2. Applied Radiobiology
Fractionation: rationale, factors involved (4 R's).
Time, dose, and fractionation relationship: iso-effect curves, iso-effect relationships, e.g. NSD,
CRE formalisms and their limitations, partial tolerance, means of summating partial tolerance, steepness of dose response curves.
Multi-target, two components and linear quadratic model, a/b ratios for acute- and chronic effects and means of deriving these values, iso-effective formulae, clinical applications of me L-Q model, nyperfractionation, accelerated fractionation. hypofractionation, CHART, split dose treatments.
Bracthytherapy - low dose rate, high dose rate and pulsed treatments.
Introduction to new techniques to optimize radio-curability; combination therapy (adjuvant surgery or chemotherapy), hyporthermia, hypoxic cell radio-sensitizes, high LET radiation. Photodynamic therapy.
The volume effect, genera! principles and current hypotheses. Shrinking Field technique.

Combination Radiation – Surgery:
Pre-, post- and intra-operative radiation.
Rationale, radiobiological factors, current clinical results.
Irradiation of sub-Clinical disease, debulking surgery, importance of clonogen numbers.

Combination Radiation-Chemotherapy:
Definitions of radio-sensitizer, synergism, potentiation, antagonism.
Radio-sensitizers: types, mechanism.
Hyperthermia Sources, rationale (historical examples), advantages and disadvantages, thermotolerance

Cellular damage; comparison and contrast with radiation, thermal and non-thermal effects of ultrasound, microwaves, radiofrequency, etc. General host responses (immunology, metastases).

Use along with radiotherapy and chemotherapy: optimum sequencing of combined modalities. Current limitations to the clinical use of hyperthermia.

1.2.1. High LET Radiation

Comparison and contrast with low LET radiation.

Neutrons: source (including 252 cf) and boron neutron capture Advantages and disadvantages of neutrons, RBE values, hazards of low dose energy neutron, use in radiotherapy, combination with low LET, current clinical other high LET particles: protons, mesons, high-energy heavy nuclei radiotherapy, current clinical results.

1.2.2. Clinical trials - Statistical basis for planning & interpretation

Clinical Trials.

- Advantages & disadvantages
- Retrospective & prospective studies
- Controlled & uncontrolled trials
- Single-blind & double-blind studies
- Phase I, II & 111 trials
- Ethics (Helsinki declaration).

Planning a trial

- Establishing objectives- short term and long term
- Determining the appropriate criteria.
- Establishing grounds for inclusion and exclusion of patients

- Determining how many treatment schedules are to be completed
- Determining the treatment schedules and any appropriate modifications
- Determining the method of allocation of treatments; the allocation ratio and the method of randomization
- Determining what measures are to be taken, how they will be taken, who will take them, what time(s) and where they will be recorded
- Designing the appropriate forms of documentation
- Determining the proposed duration of the trial, either in terms of a fixed closing date, or entry of a pre-determined number of patients
- Establishing conditions under which the trial may be terminated earlier than planned procedures for detecting these conditions.
- Re-assessing the proposed trial in terms of ethics, appropriateness to the short & long objectives, feasibility & the availability of resources.
- Writing the protocol
- Running a pilot study

2. CLINICAL RADIOTHERAPY AND ONCOLOGY

2.1. Cancer Epidemiology & Etiology

2.2. Assessment & referral systems for radiotherapy and Diagnostic workup.

2.3. Care & evaluation during & after treatment

2.4. Emergencies in Oncology

2.5. Management of different malignancies treatment Response & Result

2.6. Pediatric Oncology

2.7. Guidelines for treatment response assessment.- Complete Response, Partial Response, No Response, Stable disease.

2.8. End points of treatment results: Loco-regional control, recurrence, metastasis, survival, and quality

2.9. Treatment related morbidity assessment

i) Radiation morbidity (early & late)

ii) Morbidities of combined treatment

iii) Grading Systems.

3. MEDICAL ONCOLOGY AND ALLIED AREAS

3.1 Basic principles of chemotherapy

3.1.1. Chemotherapy drugs.

3.1.2. Newer chemotherapeutic agents.

3.1.3. (Basis for designing different chemotherapy schedules. Standard chemotherapy schedules.

3.1.4. Themotherapy practice in various malignancies

3.1.5. Chemotherapy practice, results/ toxicities in sequential & concomitant chemo- radiotherapy.

3.1,6. Supportive care for chemotherapy.

3.1.7. The basic principles underlying the use of chemotherapeutic agents.

a) Classification and mode of action of cytotoxic drugs The principles of cell kill by chemotherapeutic agents, drug resistance, phase specific and cycle.

b) Drug administration; The genera principles of pharmacokinetics; factors affecting drug concentration "in Vivo" including route and timing of adsministration, drug activation, .plasma concentration, metabolism . and clearance.

c) Principles of combinations of therapy, dose response curves, adjuvant and neo-adjuvant chemotherapy, sanctuary sites, high dose chemotherapy.

d) Toxicity of Drugs:. Early, in termed; cite and late genetic end somatic common classes of anticancer drugs. Precautions in the safe handling of drugs.

e) Endocrine manipulation and biological response modifiers. An understanding of the mode of action and side effects of common hormonal preparation cancer therapy (including corticosteroids)

f) Use of the major biological modifiers such as interferon, interleukins and growth factors and their known side effects.

g) Assessment of New Agents. Principles of phase I, II, and ill studies

h) Gene Therapy

3.2 Hematological malignancy and medical complications

3.3.1. Other Disciplines allied to Radiotherapy and Oncology

3.3.2. Surgical Oncology

3.3.2.1. Basic principles of surgical oncology, biopsy, conservation surgery, radical surgery palliative surgery.

3.3.2.2. Basics of surgical techniques- head & neck, breast, thorax, abdomen, gynecology genitourinary, musculoskeletal, CNS.

3.3.2.3. Combined treatments/with radiotherapy, chemotherapy, and hormone therapy

4. **Palliative Care**

15. Annexure:

Clinical Training Rotation

Block 1							
Months	1st	2nd	3rd	4th	5th	6th	
Educational program	Competence based learning on medical oncology. Biostatistics, Applied immunology, Genetics, Cancer epidemiology, Medical education.						E O B A
Clinical training rotation	Inpatient , Outpatient, Emergency.						
Thesis Work	Protocol development /submission/RB clearance.						

Block 2							
Months	7th	8th	9th	10th	11th	12th	
Educational program	Continued						E O B A
Clinical training rotation	Applied Radiation physic and treatment planning.						
Thesis Work	Patient enrolment, intervention and data collection						

Block 3							
Months	13th	14th	15th	16th	17th	18th	
Educational program	Knowledge on oncologic allied subjects - Psychiatry (15 days on month 13th), Palliative and Terminal care (30 days on month 14th), Skin & VD (15 days on month 15th), ENT (30 days on month 16th), Transfusion Medicine (7 days on month 17th).						E O B A
Clinical training rotation	Applied Radiation physic and treatment planning.						
Thesis Work	Patient enrolment, intervention and data collection						

Block 4							
Months	19th	2oth	21st	22nd	23rd	24th	
Educational program	Knowledge on Radiation Oncology						E O B A
Clinical training rotation	Inpatient , Outpatient, Emergency						
Thesis Work	Patient enrolment, intervention and data collection						

Block 5							
Months	25th	26th	27th	28th	29th	30th	
Educational program	Competence based learning on Radiation Therapy Machine Treatment						E O B A
Clinical training rotation	Advanced treatment planning and clinical Radiotherapy						
Thesis Work	Data processing and analysis.						

Block 6							
Months	31st	32nd	33rd		34th	35th	36th
Educational program	Continued			E O B A	Eligibility Assessment and Phase B final examination.		
Clinical training rotation	Continued						
Thesis Work	Report writing and submission						

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