P.G. PROGRAM M. Sc. Medical Physics

SEM-IV

Paper I-Quality Control, Acceptance Testing and Calibration of Radiation System

SUB-JECT CODE	Catego-ry	SUBJECT NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem Universi ty Exam	Two Term Exam	Teac hers Ass ess men t	End Sem Uni vers ity Exa m	Tea che rs Ass ess me nt				
MSMP401	DC	Quality Control, Acceptance Testing and Calibration of Radiation System	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of Quality Control, Acceptance Testing and Calibration of Radiation System

Course Outcomes:-

1. Student will be able to understand and solve the problems related to Quality Control, Acceptance Testing and Calibration of Radiation System

SYLLABUS

MSMP401: QUALITY CONTROL, ACCEPTANCE TESTING AND CALIBRATION OF RADIATION SYSTEM

Unit-1

Need for quality assurance, protocol in radiation therapy, beam therapy, errors- errors in source to skin distance, time, field size, alignment of radiation and optical fields, safety system and warning lights, mechanical characteristics, correspondence between the axis of rotation of collimator and light beam axis, location of the isocentre point, symmetry and parallelism of collimation jaws, energy stability, other parameters, error propagation.

Unit-2

QA of radiation therapy equipment, QA test for medical accelerators, QA protocol in Brachy therapy equipment, plant treatment parameters, QA protocol interlocks and operational feedback, functional QA procedures, equipment simulator, technical irradiation tolerance, Radiation protection survey, Documentation and quality assurance, record documentation for beam therapy, treatment planning system.

Unit-3

Dose calculation models, operating instructions and data input, manufacturer's test, procedure of the TPF, dose prescription, Calibration methods, duration of dose delivery, documentation of physical parameters, DVH, quality indices, Magnetic resonance imaging (MRI), Phantom materials, resonance frequency, signal to noise ratio, image uniformity, spatial linearity, high contract spatial resolution.

Unit-4

QA for Radiation measuring equipment and dosimetry; Quality assurance, procedure, radiation generators, radiation measuring equipments, water phantom, routine QC tests, quality auditing, Dose measuring equipments, Physical examination, leakage check, voltage check, ion chamber, cable triaxial connector, constancy of calibration, beam data generating equipment, source calibration equipment.

Unit-5

Planning of radiation installation of various types for different applications (X-raydiagnostic, deep therapy, telegamma, accelerator installations, nuclear medicine etc.), effects of scattering, albedo, skyshine, noxious gas production, designing of shielded containers for storage or transport of radioactive materials, (Eg; Gamma chamber, radiographic exposure device, etc.). –Planning of accelerators and reactor installations.

References

1. W.R.Hendee, "Medical Radiation Physics", YearBook – Medical Publishers Inc. London.
2. H.Handee, Radiation Therapy Physics.
3. M.M.Rehani, Quality assurance in diagnostic radiology.
4. FaizM.Khan Roger A.Potish, Treatment Planning in Radiation Oncology.

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P.G. PROGRAM M. Sc. Medical Physics

SEM-IV

PAPER II- RADIOTHERAPY PLANNING

SUB-JECT CODE	Cate-gory	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSMP402	DC	**RADIOTHERAPY PLANNING**	6o	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of Radiotherapy Planning

Course Outcomes:-

2. Student will be able to understand and solve the problems related to Radiotherapy Planning

SYLLABUS

MSMP 402: RADIOTHERAPY PLANNING

Unit-1

Beam therapy including modern trends: benign and malignant tumors, tissue tolerance dose and tumor lethal dose, fractionation, palliative and curative therapy, spectral distribution of x-rays, dose measurement, check phantom, output calibration procedures. Back scatter and central axis depth dose.

Unit-2

Rotation therapy and tissue air ratio, tissue maximum ratio, integral dose, tegamma therapy, megavoltage X-ray therapy, electron contamination, articulate beam therapy, heavy ion therapy, adjuncts such as hyper baric oxygen, hyperthermia, radio sensitizers and chemo therapy.

Unit-3

Treatment planning in teletherapy: Manual treatment planning and dosimetry and modern computerized Tumor localization, various methods, use of diagnostic systems, simulator, CT simulation, imaging in radiotherapy, Patient Data Acquisition, Radiotherapy Simulation, Patient Positioning and Immobilization, Treatment Planning Algorithms for Photon and Electron beams.

Unit-4

3D conformal radiotherapy, intensity modulated radiotherapy, gamma knife and X knife procedures and planning, treatment plan evaluation, radiobiological principles of fractionation, gap correction and evaluation of combine modalities of treatment,-Assessment of target volume, contours, direction of beams or arrangement of sources.

Unit-5

QA for treatment planning process; Treatment planning processes, positioning and immobilization, data acquisition, contouring data transfer, target volume and normal organ definition, computation of dose distributions, plan evaluation, monitoring units, beam modifier, plan implementation, treatment planning, review for individual patients, monitor unit, calculation review, plan implementation review in vivo dosimetry.

References

1. H.E.Jones, J.R.Cunnigham, "The Physics of Radiology" Charles C.Thomas, NY.
2. W.J.Meredith and J.B.Massey "Fundamental Physics of Radiology", John Wright and Sons, UK.
3. W.R.Hendee, "Medical Radiation Physics", YearBook – Medical Publishers Inc. London.
4. R.F.Mould, "Radiotherapy Treatment Planning Medical Physics Hand Book Series No.7, Adam Hilger Ltd, Bristol.
5. Faiz M.Khan and Roger A.Potish, Treatment Planning in Radiation Oncology, Williams & Wilkins.

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SEM-IV

Paper III- MODERN TRENDS IN RADIOLOGY AND RADIATION THERAPY

SUB-JECT CODE	Cate-gory	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSMP403	DC	MODERN TRENDS IN RADIOLOGY AND RADIATION THERAPY	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of Modern Trends in Radiology and Radiation Therapy

Course Outcomes:-

1. Student will be able to understand and solve the problems related to Modern Trends in Radiology and Radiation Therapy

SYLLABUS

MSMP403: MODERN TRENDS IN RADIOLOGY AND RADIATION THERAPY

Unit-1

Modern trends in imaging techniques: Recent advances in diagnostic radiology-New equipment for chest imaging, Digital Radiography, Digital Subtraction radiography (DSA), Xero radiography, mammography, CT scanners and their applications Principles of Computed Tomography: Basic principles of data accumulation, storage, image reconstruction and display. CT numbers, different generations of CT machines, reasons for higher contrast and resolution, various scan configurations, modern developments like CVCT, spiral CT, 3D reconstruction. Characteristics of X-ray tubes in CT units.

Unit-2

New simulators with image freezing, CT simulation, simulated CT, New linear accelerators, portal imaging with gas filled and solid state detectors, DPR with high energy beams, three dimensional radio therapy, physics and treatment planning, development of 3D TPS, volume and dose specificati0n for 3D planning, concept of GTV, CTV, PTV, etc. conformal radiotherapy, Dose computational methods, Dose Volume Histogram, Planning and evaluation, Plan optimization, QA for 3D CRT, future directions in 3D CRT.

Unit-3

Volume Histogram, Planning and evaluation, Plan optimization, QA for 3D CRT, future directions in 3D CRT. Stereotactic irradiation, techniques and implementation, Radiosurgery system, Gamma knife, Linac based surgery, Cone and special applicators, MLC, MMLC, DMLC based surgery, STR, Intensity modulated radio therapy, Inverse planning, IMRT based on compensators, DMLC etc, Advantages of IMRT over SRT and SRS.

Unit-4

Intra Operative Radiotherapy, advances in Brachy therapy, LDR, PDR, HDR systems, Stereotactic guided Brachy therapy, Intra Operative Brachy therapy, Templates, perennial templates for Cervix Prostrate and rectum, Ultrasound guided implant, Dwell time and dwell position optimization, dose prescription according to radiobiology, Iodine seeds for prostrate cancer.

Unit-5

Modern innovations like gamma knife, X knife conformal radiotherapy and planning of the same. Recent developments in Brachytherapy and use of new radionuclides, 3D planning.

References

1. James A. Purdy, Walter H. Grant III, Jatinder R. Palta, E. Brian Butter, Carlos A. Perez, 3D Conformal and Intensity Modulated Radiation Therapy- Physics and Clinical Applications, Publisher, ISBN 2004.
2. S. Webb, Intensity Modulated Radiation Therapy, IOP Publishing Ltd.
3. S. Webb, The Physics of Conformal Therapy - Advances in Technology by IOP Publishing Ltd.
4. Lowrence Coy, A Practial Guide to CT simulation, https://aapm.onlinelibrary.wiley.com/doi/abs/10.1118/1.597784.
5. S. Webb, The Physics of Medical Imaging, Medical Science Series, Adam Hilger, Bristol.

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P.G. PROGRAM M. Sc. Medical Physics

SEM-IV

PAPER IV- RESEARCH AND INDUSTRIAL APPLICATIONS OF RADIATIONS

SUB-JECT CODE	Cate-gory	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSMP404	DC	Research and Industrial Applications of Radiations	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of Research and Industrial Applications of Radiations

Course Outcomes:-

1. Student will be able to understand and solve the problems related to Research and Industrial Applications of Radiations

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SYLLABUS

MSMP404: RESEARCH AND INDUSTRIAL APPLICATIONS OF RADIATIONS

Unit -1

Industrial application of radiation: Principles of industrial radiography with x ray and gamma ray, radiographic exposure devices, photographic film technique, radiographic contrast, definition and sensitivity, intensifying screens and pentameters, Principle and measurement of thickness and level in different application, density and moisture hydrogen in hydrocarbons, well logging, composition analysis.

Unit-2

Principle of operation of consumer products using radiation sources fire detector, baggage inspection systems, static eliminator, luminous paints and gas mantles. Industrial radiation processing, gamma chambers, radiation sterilization, irradiation of food and medical products

Unit-3

Industrial radiation processing, gamma chambers, radiation sterilization, irradiation of food and medical products, Radioisotope tracer applications, Measurement of flow rate, Determination of phosphorous and sulphur content in shell, Diffusion and vapour pressure measurements, Detection of animal and plant diseases by tracer method, Preservation of foods, drugs and vegetables.

Unit-4

Specialized applications of radioisotopes in industry and the life sciences, Attenuation of beta particles and electrons in paper manufacturing, Multi element analysis, thin layer activation, smoke detectors, mineral processing, coastal engineering, flow rate measurement, gas, liquid, river flow, erosion studies, use of Cesium, ground water management, Oceanography, effect of high energy radiation on polymers.

Unit-5

Radioisotope gauges: Use of transmission gauges for measurement of thickness, density and composition, Level indicator, Use of back scatter gauges for measurements of the thicknesses of coatings, Details about current suppliers and procedures for procurement of sources, Planning of radioisotope laboratories for agricultural and research institutions, Design of gamma gardens for agriculture.

References

1. Practical Applications of Radioactivity and Nuclear Radiations, G.C.Lowental and P.L.Airey, Cambridge Universiyt Press, U.K.
2. J.R.Greening "Fundamentals of Radiation Dosimetry", Medical Physics Hand Book Series No.6 Adam Hilger Ltd., Bristol.
3. A.Martin and S.A.Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York.

P.G. PROGRAM

M. Sc. (Medical Physics)

SEM-IV

Paper V- Comprehensive Viva

SUB-JECT CODE	Cate-gory	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSMPCV 405	DC	Comprehensive Viva	00	00	00	00	00	0	0	0	4

Comprehensive Viva will be based on the all subjects of the IV sem.

Total Marks: 100

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SEM –IV

Paper VI- Project Phase –II & Presentation

SUB-JECT CODE	Cate-gory	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSMPPR 406	DC	Project Phase –II & Presentation	00	00	00	00	00	0	0	16	8

Total Marks: 200