Reg. No. ☐☐☐☐☐☐☐☐☐☐

MANIPAL UNIVERSITY

THIRD SEMESTER M.Sc. (RADIATION PHYSICS) DEGREE EXAMINATION – JANUARY 2012

SUBJECT: PHYSICS OF MEDICAL IMAGING

Monday, January 02, 2012

Time: 10:00 – 13:00 Hrs.   Max. Marks: 80

✍ **Answer ALL the questions.**

PART – A

1. Discuss contrast reduction by scattered radiation and explain in detail how grid performance can be evaluated using Primary Transmission, Bucky factor and Contrast improvement factor.

(20 marks)

2. Describe in detail any five Quality Assurance tests with necessary test tools in diagnostic radiology.

(20 marks)

3. Discuss in detail the physical principle of Magnetic Resonance Imaging scanner.

(20 marks)

PART – B

4. **Write short notes on:**

4A. Characteristic radiation

4B. Piezoelectric effect

4C. Photostimulable phosphor

4D. Ring Artifact

(5×4 = 20 marks)

MANIPAL UNIVERSITY

THIRD SEMESTER M.Sc. (RADIATION PHYSICS) DEGREE EXAMINATION – JANUARY 2012

SUBJECT: PHYSICS OF RADIOTHERAPY

Wednesday, January 04, 2012

Time: 10:00 – 13:00 Hrs.   Max. Marks: 80

✍ **Answer ALL the questions.**

PART – A

1A. Write in detail about different methods to correct contour Irregularities.

1B. Explain in detail how field separation is achieved geometrically.

(10+10 = 20 marks)

2. Discuss the following aspects of Treatment Planning in Electron Beam Therapy with necessary diagrams:

2A. Choice of energy and field size

2B. Corrections for Air Gaps and Beam Obliquity

2C. Tissue in-homogeneities

(5+7+8 = 20 marks)

3A. What are the features of Brachytherapy?

3B. Describe the isotopes used for Brachytherapy. Why the use of Radium has been discontinued?

(10+10 = 20 marks)

PART – B

4. Write about Integral dose.

5. A single field 6-MV beam is used to deliver 200 cGy at the isocenter (100 cm SAD), which is at a depth of 10 cm. The patient thickness is 20cm. using the factors given below, calculate the dose at 5 cm depth.

%DD for 100 cm SSD, 5cm depth	87%
%DD for 100 cm SSD, 10cm depth	68%
TMR 5-cm depth	0.93
TMR 10-cm depth	0.79
TMR 15-cm depth	0.65
TMR 20-cm depth	0.53

6. Write about Computer System for implantation.

7. Brief Direct Monte-carlo.

(5×4 = 20 marks)

✍   **Answer ALL the questions.**

1.   A male patient has been referred to the department of nuclear medicine for a lung perfusion and ventilation scan.

1A.   What are the radiopharmaceuticals which can be used for perfusion imaging of the lungs?

1B.   Name the two pseudogases you know of.

1C.   Which radiopharmaceutical can be used for the estimation of lung capillary permeability?

1D.   What are the critical organs for a lung perfusion and ventilation scan.

1E.   What do you mean by a ventilation perfusion mismatch?

(5+5+2+4+4 = 20 marks)

2.   What is the significance of quality control of radiopharmaceutical? How is paper chromatography applicable in this context?

(4+16 = 20 marks)

3.   What do you mean by 'image reconstruction' in a SPECT study? Explain any one method with illustration or diagram.

(20 marks)

4.   **Write Short Notes on:**

4A.   Blood volume estimation

4B.   RBC survival study

4C.   Resolution

4D.   Sensitivity

(5×4 = 20 marks)

MANIPAL UNIVERSITY

THIRD SEMESTER M.Sc. (RADIATION PHYSICS) DEGREE EXAMINATION – JANUARY 2012

SUBJECT: RADIATION SAFETY AND REGULATIONS

Monday, January 09, 2012

Time: 10:00 – 13:00 Hrs.   Max. Marks: 80

✍   **Answer ALL the questions.**

1.   Describe the design and planning of a Cobalt Teletherapy Treatment Room.

(20 marks)

2A.   Discuss the basis for setting up Dose Limits for Occupational Exposure.

2B.   What is the thickness of the concrete required to bring the dose level to 0.35 mGy/wk at point

of 3 meter from a 200 RMM cobalt teletherapy source?

Data: machine is 'ON' for 20 hrs/wk

(10+10 = 20 marks)

3.   Write down the safety precautions to be taken in I – 131 ablation therapy?

(20 marks)

4.   **Write a short note on the following:**

4A.   TREMCARD

4B.   What is contamination? How will you control it and what are the precautions to be taken to

avoid it?

4C.   Personnel Monitoring T L D Badge

4D.   Equivalent Dose and Effective Dose

(5×4 = 20 marks)

MANIPAL UNIVERSITY

THIRD SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – JUNE 2012

SUBJECT: PHYSICS OF MEDICAL IMAGING

Monday, June 11, 2012

Time: 10:00 – 13:00 Hrs.   Max. Marks: 80

✍ **Answer ALL the questions.**

1A. Discuss about the scatter reduction management in X-ray imaging.

1B. Discuss about the construction of intensifying screens.

(10+10 = 20 marks)

2A. Write in brief about detectors used in CT scanners.

2B. Write in brief about multi-section CT.

(10+10 = 20 marks)

3. Describe any five QA tests with necessary test tools in diagnostic radiology.

(20 marks)

4. **Write short notes on**:

4A. Transducers

4B. Grids

4C. Magnets used in MRI

4D. Importance of photoelectric effect in diagnostic radiology

(5×4 = 20 marks)

MANIPAL UNIVERSITY

THIRD SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – JUNE 2012

SUBJECT: PHYSICS OF RADIOTHERAPY

Wednesday, June 13, 2012

Time: 10:00 – 13:00 Hrs.   Max. Marks: 80

✍   **Answer ALL the questions.**

1.   **Derive the following:**

1A. Relationship between TAR and PDD

1B. Relationship between TMR and PDD

1C. Phantom scatter factor

1D. Scatter maximum ratio

$(5\times4 = 20$ marks)

2A. Discuss in detail Treatment Planning Algorithms for Electron beams with diagrams wherever necessary.

2B. Explain Field Flatness in Large Field Technique for Total Skin Irradiation.

$(15+5 = 20$ marks)

3.   Discuss in detail AAPM TG-43 formalism.

(20 marks)

4.   Explain briefly about EPID.

(5 marks)

5.   Write briefly about treatment simulator.

(5 marks)

6.   Write in brief about Treatment Planning System Quality Assurance.

(5 marks)

7.   Explain Dose Volume Histogram.

(5 marks)

MANIPAL UNIVERSITY

THIRD SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – JUNE 2012

SUBJECT: PHYSICS IN NUCLEAR MEDICINE

Friday, June 15, 2012

Time: 10:00 – 13:00 Hrs.   Max. Marks: 80

✍ **Answer ALL the questions.**

1.   A 25 yrs old lactating female patient with a history of carcinoma of the thyroid has been operated upon. She has been referred to the Department of Nuclear Medicine for ablation of the remnant thyroid tissue (High dose therapy).

1A.   What will you advice the patient regarding:

    i)   Pre therapy precautions

    ii)   Instructions during her stay in the isolation ward

    iii)   Instructions when she returns home

1B.   Discuss the radiation exposure limits laid down by AERB for these patients.

(15+5 = 20 marks)

2.   What are the different principles of radiation detection? With a neat and labelled diagram explain a gas filled detector.

(6+14 = 20 marks)

3.   How is SPECT QC different from planar QC? Explain the QC test for SPECT in details.

(5+15 = 20 marks)

4.   **Write short notes on:**

4A.   Dual isotope testing for vit B12 deficiency

4B.   3 phase bone scan-procedure protocol

4C.   Bar phantom

4D.   Gamma Ray Spectrum

(5×4 = 20 marks)

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MANIPAL UNIVERSITY

THIRD SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – JUNE 2012

SUBJECT: RADIATION SAFETY AND REGULATIONS

Monday, June 18, 2012

Time: 10:00 – 13:00 Hrs.   Max. Marks: 80

✎   **Answer ALL the questions.**

1A.   Describe the procedures used to receive and ship Ir-192 brachytherapy sources.

1B.   Describe the commissioning process for a cobalt teletherapy unit.

(10+10 = 20 marks)

2A.   It is proposed to treat 50 patients/day to a dose of 200 cGy per day in a 18MV LINAC. Calculate thickness of the primary wall in the treatment room at 4 meters to bring the dose to the dose limit for a partially occupied area. (TVL for 18 MV is 46.7 cm. concrete)

2B.   What are the aims of radiation protection?

(10+10 = 20 marks)

3A.   Give some of the emergency situations that may arise in Nuclear Medicine Department. How do they occur? How can you prevent them?

3B.   Describe the procedure monitoring contamination and decontamination.

(10+10 = 20 marks)

4.   **Write a short note on the following:**

4A.   Tissue Weighting Factor

4B.   Radioactive packages

4C.   Stochastic and non-stochastic effects

4D.   ALARA

(5×4 = 20 marks)

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