Reg. No.									

MANIPAL UNIVERSITY

FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – JANUARY 2013

SUBJECT: BASIC MEDICAL SCIENCES (ANATOMY & PHYSIOLOGY)

Wednesday, January 02, 2013

Time: 10:00 – 13:00 Hrs. Max. Marks: 50

- **Answer both Section 'A' and 'B' in TWO Separate Answer Books.**
- **Answer ALL questions. Draw diagrams wherever necessary.**

SECTION – A: ANATOMY: 25 MARKS

1. Name the parts of respiratory system. Add a note on pharynx.

(4+6 = 10 marks)

2. Write short notes on:

2A. Structure of a bone
2B. Golgiapparatus
2C. Circle of Willis
2D. Middle ear
2E. Smooth muscle

(3×5 = 15 marks)

SECTION – B: PHYSIOLOGY: 25 MARKS

3. Essay questions:

3A. Define GFR. Give its normal value. Mention THREE factors affecting GFR.
3B. Draw and name the components of a reflex arc.
3C. Write five functions of blood.

(5×3 = 15 marks)

4. Write short answers for the following:

4A. Mention two functions of salivary secretion.
4B. Enumerate any two functions of the hormones secreted from the female gonads.
4C. Name the receptors for sound and name the location of the same.
4D. Define cardiac output. Give its normal value.
4E. What is inspiratory reserve volume and give the normal value?

(2×5 = 10 marks)

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FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – JANUARY 2013

SUBJECT: MATHEMATICAL METHODS IN PHYSICS
(COMMON FOR BOTH OLD AND NEW REGULATION)

Friday, January 04, 2013

Time: 10:00 – 13:00 Hrs. Max. Marks: 100

Answer all the questions.

1A. Define a surjective function. Solve equations graphically $tanx = 1.2x$.

1B. State and prove Lagrange's mean value theorem.

1C. Show that $\lim_{x\to 0} \frac{tanx}{x} = 1$.

(5+5+5 = 15 marks)

2A. Evaluate the following limits.

i) $\lim_{x\to 3} \frac{\sqrt{2x+3}-\sqrt{4x-3}}{x^3-27}$ ii) $\lim_{x\to 3} \frac{x^2-9}{x^3-6x^2+11x-6}$

iii) $\lim_{x\to 3} \frac{x^2\sqrt{x}-27\sqrt{3}}{x-3}$

(7+7+3 = 17 marks)

2B. Find the derivatives of the following functions.

i) $sin^{-1}(2^{-x})$ ii) $\log\left[\frac{1+x}{1-x}\right]^{1/4} - \frac{1}{2}tan^{-1}x$

(6+7 = 13 marks)

2C. Evaluate the following integrals.

i) $\int \frac{cot(sin^{-1}x)}{\sqrt{1-x^2}}dx$ ii) $\int_1^e \frac{4^{logx}}{x}dx$

(8+6 = 14 marks)

3A. Find the inverse Laplace transform of the following function $\frac{1}{(s+1)(s^2+4)}$

3B. Evaluate the following integrals.

i) $\int_0^\infty \frac{e^{-x^2}}{\sqrt{x}}dx \cdot \int_0^\infty x^2 e^{-x^4}\,dx$

ii) $\int_0^\infty \frac{e^{-t}sint}{t}dt$

3C. Solve the equation $y'' + 2y' + 5y = 0$ given $y(0) = 0$ and $y'(0) = 1$

(5+(6+5)+5 = 21 marks)

4A. Find the percentage error in the surface area and volume of a sphere of radius r, if r is measured as 18.5 inches with a possible error in 0.1 inch.

4B. Examine the following function for extreme values:

$f(x,y) = x^4 + y^4 - x^2 - y^2$

(4+5 = 9 marks)

5A. A radium decomposes at a rate proportional to the quantity of radium present. Suppose that it is found that in 25 years approximately 1.1% of a certain quantity of radium has decomposed, determine approximately how long will it take for one half of the original amount of radium to decompose.

5B. Solve $\frac{dy}{dx} = (4x + y + 1)^2$, Given $y(0) = 1$.

(6+5 = 11 marks)

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FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – JANUARY 2013

SUBJECT: ELECTRONICS
(COMMON FOR BOTH OLD AND NEW REGULATION)

Monday, January 07, 2013

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

- **Answer ALL the questions.**
- **Any missing data may be assumed suitably.**

PART – A

1. Answer the following:

1A. Explain Zener regulator along with neat circuit diagram.

1B. What are the factors that decide the selection of a transducer?

1C. Compare different transistor configurations using proper diagrams.

1D. Write and explain the principle of parallel resonance with circuit diagram and graph.

1E. For a silicon p-n junction diode, for what value of reverse voltage with the reverse current reach 80% of its saturation value at 27°C.

1F. Explain the method of liquid level measurement using a neat sketch.

1G. Explain the construction and working of varactor diode using proper diagrams and symbols.

1H. Narrate the functioning of n-channel J FET.

(5×8 = 40 marks)

PART – B

2. Answer the following:

2A. With relevant sketches explain inverting and non inverting amplifier using op-amps.

2B. Describe piezoelectric strain and force transducer.

2C. Write a note on magnetic materials.

2D. With the help of block diagram explain IC 555 Timer.

2E. Define the four h-parameters using proper block diagrams.

(8×5 = 40 marks)

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MANIPAL UNIVERSITY

FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – JANUARY 2013

SUBJECT: MODERN PHYSICS

Wednesday, January 09, 2013

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

Answer ALL questions. Any missing data may be assumed suitably.

***Physical Constants*:**

Speed of light in vacuum, $c = 3 \times 10^8$ m/s
Atomic mass unit, $u = 1.67 \times 10^{-27}$ kg
Proton mass, $m_p = 1.67 \times 10^{-27}$ kg
Electronic charge, $e = 1.602 \times 10^{-19}$C
Planck's constant, $h = 6.626 \times 10^{-34}$ Js
Electron mass, $m_e = 9.11 \times 10^{-31}$ kg
Neutron mass, $m_n = 1.67 \times 10^{-27}$ kg
$1\ eV = 1.602 \times 10^{-19}$J

1A. Explain how *Davisson and Germer's experiment* on electron diffraction establishes de-Broglie's hypothesis on matter waves.

1B. What is a *wave packet*? Write a note on *phase velocity* and *group velocity*. Obtain a relation between phase velocity and group velocity. Show that group velocity of matter wave is equal to particle velocity.

1C. Evaluate de-Broglie wavelength of Helium nucleus that is accelerated through a potential difference of 500V.

(6+6+4 = 16 marks)

2A. Establish Schrodinger's equation for a particle in a potential well of *infinite height* and solve it to obtain its energy levels.

2B. Discuss the determination of nuclear radius using classical ideas by *α-scattering experiment*. Write a note on charge density distribution within the nucleus.

2C. An electron is trapped in a one-dimensional potential well of width 0.1 nm and infinite height. Find the amount of energy required to excite the electron to its first excited state. What is the probability of finding the electron in its first excited state between $x = 0.04$ nm & $x = 0.06$ nm?

(6+6+4 = 16 marks)

3A. Explain the *quantum mechanical tunnelling* process during α-decay.

3B. Based on *Fermi's theory of beta decay* obtain the expression for Fermi distribution of emitted beta particles.

3C. A self quenched Gieger Muller Counter operates at 1000 V and has a central wire of diameter 0.2 mm. The diameter of the cathode is 2 cm and the tube has a guaranteed lifetime of 10^9 counts. i) What is the maximum filed? ii) How long will the counter last if it is used on an average of 30 hrs per week at 3000 counts per minute?

(6+6+4 = 16 marks)

4A. Discuss the experimental set up used by Cowan and Reins for the *detection of neutrino*.

4B. Explain the variation of pulse height with applied voltage in the case of a *gas filled counter*.

4C. Calculate the energy released (in eV) during the fission reaction of U-235, when the masses of U-235, Ba-141, Kr-92 and neutron are 235.04278u, 140.9129u, 91.89719u and 1.00866u respectively.

(6+6+4 = 16 marks)

5A. Using the semi-empirical binding energy formula plot *mass parabolas* and explain the stability of nuclei against beta decay.

5B. Discuss the following terms pertaining to slowing down of neutrons in matter:

i) *Mean energy loss* ii) *Slowing down power* and iii) *Moderating ratio*.

5C. A ruby laser emits light of wavelength 693.4 nm. Assuming that, this light is due to transition of an electron in an infinite height potential box from the $n = 2$ state to $n = 1$ state, find the width of the box.

(6+6+4 = 16 marks)

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MANIPAL UNIVERSITY

FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – JANUARY 2013

SUBJECT: FUNDAMENTALS OF COMPUTERS AND COMPUTER PROGRAMMING

Friday, January 11, 2013

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

Answer any FIVE full questions.

1A. Explain the parts of a computer with a neat block diagram.

1B. Explain the features of the first generation of computers. Give examples.

1C. What are the different data types supported in the C programming language?

(7+4+5 = 16 marks)

2. Perform the following number system conversions

i) $(110.101)_2$ = (_____)$_{10}$ ii) $(4756)_8$ = (_____)$_{10}$

iii) $(C78E)_{16}$ = (_____)$_8$ iv) $(1B76)_{16}$ = (_____)$_2$

(4×4 = 16 marks)

3A. Explain the working of a joystick.

3B. What are the parts of the floppy disk drive?

3C. What is bar code? Explain the working of a bar code reader.

(6+4+6 = 16 marks)

4A. What are the essential features of the 3rd generation programming languages. Give examples.

4B. What is the difference between a single user and a multi user operating system?

4C. What is an assembler?

(6+6+4 = 16 marks)

5A. Differentiate between a while loop and a do while loop with an example.

5B. Write a C program to accept a matrix of order n × m. Obtain the transpose of the matrix and hence determine whether the matrix is a symmetric matrix or not.

(6+10 = 16 marks)

6A. What is a network? Explain with neat diagrams, the differences between the mesh and ring topologies.

6B. What are the essential features of a word processor? Give examples.

(12+4 = 16 marks)

7A. What is an Image? What is the purpose of Image Processing?

7B. What is Image compression? Differentiate between lossy and lossless Image compression.

(8+8 = 16 marks)

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MANIPAL UNIVERSITY

FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – MAY 2013

SUBJECT: MATHEMATICAL METHODS IN PHYSICS
(COMMON FOR BOTH OLD AND NEW REGULATION)

Tuesday, May 28, 2013

Time: 10:00 – 13:00 Hrs. Max. Marks: 100

✍ **Answer all the questions.**

1A. Obtain the domain of the following functions.

a) $y = \sqrt{x - \frac{x}{1-x}}$ b) $y = \sqrt{x^3 - x}$

1B. Obtain the graph of $y = \begin{cases} x^2, & x < 0 \\ x, & 0 \le x < 1 \\ 1/x, & x \ge 1 \end{cases}$

1C. Show that $\lim_{x\to 0} \frac{\sin x}{x} = 1$.

((5+5)+3+5 = 18 marks)

2A. Evaluate the following limits.

i) $\lim_{x\to 0}[1 + 3x]^{1/x}$ ii) $\lim_{x\to 0} \frac{\sqrt{3+x} - \sqrt{3-x}}{x}$

iii) $\lim_{x\to 2} \frac{x^5 + 32}{x^8 - 2^8}$

(4+5+4 = 13 marks)

2B. Evaluate the following integrals.

i) $\int_0^{\pi} \frac{\sin x}{\sin x + \cos x} dx$ ii) $\int \frac{x+1}{\sqrt{x^2 - x + 1}} dx$

(6+5 = 11 marks)

2C. Find the derivatives of the following functions.

i) $y = \tan^{-1} \frac{4\sqrt{x}}{1-4x}$ ii) $y = (\sin x)^x + (x)^{\sin x}$

iii) $y = \cos\sqrt{x^2 + 3x + 4}$

(7+5+3 = 15 marks)

3A. Find the Laplace transform for the function $t^2 e^{-t} \sin 3t$

3B. Evaluate the following integrals

i) $\int_0^{\infty} \frac{x^2}{(1+x^4)^3} dx$ ii) $\int_0^{\infty} \frac{e^{-at} - e^{-bt}}{t} dt$

3C. Solve using Laplace transform the equation $y''' + 2y'' - y' - 2y = 0$ given $y(0) = y'(0) = 0$ and $y''(0) = 6$.

(4+(5+5)+6 = 20 marks)

4A. Find the stationary values of $x^2 + y^2 + z^2$ subject to the condition $xy + yz + zx = 3a^2$.

4B. Find the percentage error in the area of a rectangle when an error of 1% is made in measuring its length and breadth.

(5+3 = 8 marks)

5A. A bacterial population β is known to have a rate of growth α to β itself. If between noon and 2 pm the population triples, at what time no controls being exerted, should β become 100 times what it was at noon?

5B. Solve the following differential equations.

i) $(1 - x^2)\frac{dy}{dx} + xy = y^3 \sin^{-1} x$

ii) $\left[y\left(1 + \frac{1}{x}\right) + \cos y\right] dx + (x + \ln x - x \sin y) dy = 0$

(6+5+4 = 15 marks)

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MANIPAL UNIVERSITY

FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – MAY 2013

SUBJECT: ELECTRONICS
(COMMON FOR BOTH OLD AND NEW REGULATION)

Thursday, May 30, 2013

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

- **Answer all questions.**
- **Any missing data may be assumed suitably.**

PART – A

1. **Answer the following:**

1A. Explain the working principle of Hall effect transducer.

1B. A current of 40A flows through two ammeter A_1 and A_2 connected in series. The voltage across the two ammeters are 0.2V and 0.4V respectively. Find how the same current will divide when they are connected in parallel.

1C. With a neat block diagram describe switching regulator.

1D. Write note on n type semiconductor with proper atomic structure and energy level diagram.

1E. What is Ohms law? What is delta to Y conversion? Explain.

1F. Explain op-amp integrator with a neat circuit diagram.

1G. Differentiate active and passive elements. Briefly write a note on capacitors.

1H. What is resonance? Explain the terms selectivity and bandwidth.

(5×8 = 40 marks)

PART – B

2. **Answer the following:**

2A. What is an encoder? With neat diagram explain the concept of decimal to binary (10-4 line) encoder.

2B. Explain class B push pull power amplifier along with neat circuit. What is crossover distortion?

2C. Two impedances (21+j2) and (-20+j5) Ω are connected in parallel and this combination is connected in series with an impedance (54+jX_c) Ω. Find the value of X_c, for which resonance occurs.

2D. Explain with a neat circuit diagram and waveforms, the operation of astable multivibrator using IC 555 timer.

2E. Explain the construction and working of LCDs. Mention differences between LED and LCD.

(8×5 = 40 marks)