

B.Sc. (NON-MEDICAL) - 6th SEM. EXAMINATIONS; OCT.-2017
(SUB:-REAL AND COPMLEX ANANLYSIS; PAPER CODE: 9010601)

TIME: 03:00 Hrs.**Max Marks:40****Instructions:-**

1. Write your Roll No. on the Question Paper.
2. Candidates should ensure that they have been provided with correct question paper. Complaints in this regard, if any should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt four (4) questions in all. Question No. one (1) is compulsory. Attempt other three (3) questions selecting one (1) question from each unit. Marks are indicated against each question.
4. Draw the diagram wherever required.

Q.1. Answer all the following:**(10)**

- a) Obtain $f(x) = x$ as half range sine series in $0 < x < 2$.
- b) Find the coefficient of magnification and angle or rotation at $z = 2 + i$ for the transformation $w = z^2$.
- c) Prove that every differentiable function is continuous.
- d) Find the analytic function $f(z) = u + iv$, if $u = e^x (x \cos y - y \sin y)$.

UNIT-I**Q.2. a) Find Fourier series for the function $f(x) = |\sin x|$ in the interval $(-\pi, \pi)$.****(5)****b) Find the Half range Cosine series for $x(\pi - x)$ in $(0, \pi)$. Hence deduce that****(5)**

$$\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots$$

Q.3. a) Expand $f(x)$ as Fourier series if $f(x) = \begin{cases} -1, & -\pi \leq x < 0 \\ 1, & 0 \leq x \leq \pi \end{cases}$ **(5)**

$$\text{and prove } \frac{\pi^2}{8} = \sum_{k=1}^{\infty} (2k-1)^{-2}$$

b) Find the Fourier series for function $x \sin x$ in the interval $[-\pi, \pi]$. Hence deduce that**(5)**

$$\frac{\pi}{4} = \frac{1}{2} + \frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \dots$$

UNIT-II**Q.4. a) Show that the function $f(z) = \sqrt{|xy|}$, $z = x + iy$ is not analytic at origin, although the Cauchy - Riemann equation are satisfied at that point.****(5)****b) If $f(z) = u + iv$ and $z = re^{i\theta}$ where u, v, r, θ , are real, then**

$$\frac{\partial u}{\partial r} = \frac{1}{r} \cdot \frac{\partial v}{\partial \theta}; \quad \frac{\partial v}{\partial r} = -\frac{1}{r} \cdot \frac{\partial u}{\partial \theta}$$

(5)**P.T.O.**

- Q.5. a) If $u + v = \frac{\sin 2x}{\cosh 2y - \cos 2x}$ and $f(z) = u + iv$ is an analytic function of z , then find $f(z)$ in terms of z . (5)
- b) Prove that an analytic function with constant modulus is constant. (5)

UNIT-III

- Q.6. a) Find the image of $|z| \leq 1$ in the z -plane under the transformation $w(z + i)^2 = 1$ (5)
- b) Show that cross ratio remains invariant under the mobius transformation. (5)
- Q.7. a) Find the invariant points of the transformation $w = -\left(\frac{2z+4i}{iz+1}\right)$. Also prove that these two points together with any point z and its image w , form a set of four points having a constant cross ratio. (5)
- b) Find the image of infinite strip $\frac{1}{4} < y < \frac{1}{2}$ under the transformation $w = \frac{1}{z}$ and show the region graphically. (5)

B.Sc. (NON-MEDICAL) - 6th SEM. EXAMINATIONS; OCT.-2017
(SUB:-LINEAR ALGEBRA; PAPER CODE: 9010602)

TIME: 03:00 Hrs.

Max Marks:40

Instructions:-

1. Write your Roll No. on the Question Paper.
2. Candidates should ensure that they have been provided with correct question paper. Complaints in this regard, if any should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt four (4) questions in all. Question No. one (1) is compulsory. Attempt other three questions selecting one question from each unit. Marks are indicated against each question.
4. Draw the diagram wherever required.

Q.1. Answer all the following:**(8)**

- a) Define vector space.
- b) Define rank and nullity.
- c) Define eigen values and eigen vectors.
- d) Define orthogonal and orthonormal sets and differentiate them.

UNIT-I

Q.2. a) Prove that $s = \{ (1,0,0), (1,1,0), (1,1,0), (0,1,0) \}$ spans the vector space $R^3 (R)$ but is not basis set. **(4)**

b) Prove that the intersection of two subspaces of a vector space is a subspace. **(4)**

Q.3. a) Prove that the set $\{ (1,0,-1), (-1,0,0), (1,0,1), (2,1,3) \}$ is linearly dependent. **(4)**

b) If V is a finitely generated vector space, then any two bases of V have the same number of elements. **(4)**

UNIT-II

Q.4. a) Show that $T: R^3 \rightarrow R^2$ defined by $T(x, y, z) = (2x - 3y, 7y + 2z)$ is a linear transformation. **(4)**

b) Show that $T: R^2 \rightarrow R^3$ defined by $T(x, y) = (x, x - y, x + y)$ is a one - one linear transformation but not onto. **(4)**

Q.5. a) Give a linear transformation:

$$Y = \begin{bmatrix} 1 & 1 & 0 \\ 2 & 3 & 1 \\ 2 & 3 & 5 \end{bmatrix} X$$

Show that the images of linearly independent vectors $x_1 = (1, 1, 1)$, $X_2 = (2, 1, 2)$ and $X_3 = (1, 2, 3)$ are linearly dependent. **(4)**

- b) For the linear operation $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$, find the eigen values and the basis for eigen space, when $T(x, y, z) = (x + y + z, 2y + z, 2y + 3z)$. (4)

UNIT-III

- Q.6.** a) If α, β are vectors in a unitary space $V(F)$, then prove that
 $||\alpha + \beta||^2 - ||\alpha - \beta||^2 + i||\alpha + i\beta||^2 - i||\alpha - i\beta||^2 = 4 \langle \alpha, \beta \rangle$. (4)
- b) Let W be a orthogonal set of non-zero vectors in an inner product space. Then prove that W is linearly independent. (4)
- Q.7.** a) State and prove Bessel's inequality for finite dimensional vector space. (4)
- b) Discuss Gram-Schmidt orthogonalization process. (4)

B.Sc. (NON-MEDICAL) - 6th SEM. EXAMINATIONS; OCT.-2017
(SUB:-ATOMIC& MOLECULAR & LASER PHYSICS; PAPER CODE: 9010604)

TIME: 03:00 Hrs.**Max Marks:40****Instructions:-**

1. Write your Roll No. on the Question Paper.
2. Candidates should ensure that they have been provided with correct question paper. Complaints in this regard, if any should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt five (5) questions in all. Question No. one (1) is compulsory. Attempt other four (4) questions, selecting at least one question from each unit, in addition to Q.1. Marks are indicated against each question.
4. Draw the diagram wherever required.

Q.1. Answer all the following questions :- (4x2=8)

- a) Discuss Directionality of a laser beam.
- b) What is pumping in laser?
- c) What are penetrating and non penetrating orbits?
- d) What is Raman Effects?

UNIT-I

- Q.2. a) Derive expression of spin-orbit interaction energy for a single valence electron. (6)**
b) Discuss main features of alkali spectra. (2)

Q.3. Using LS coupling derive all the terms arising from sp systems, also show splitting due to LS interaction. (8)

UNIT-II

- Q.4. a) Calculate lande g factor for the states $^2D_{3/2}$ and $^2F_{7/2}$. (4)**
b) Discuss Stark effect. (4)

Q.5. Discuss Anomalous Zeeman effect with special reference to Zeeman pattern for D1 and D2 lines of Sodium. (8)

UNIT-III

Q.6. Give principle, construction, working and energy diagram of He-Ne laser. (8)

- Q.7. a) What is life time of a level; derive expression of its relationship with probability of transition from that level. (4)**
b) What is spatial and temporal coherence. (4)

B.Sc. (NON-MEDICAL) - 6th SEM. EXAMINATIONS; OCT.-2017
(SUB:- ORGANIC CHEMISTRY-VI; PAPER CODE: 9010609)

TIME: 03:00 Hrs.**Max Marks:40****Instructions:-**

1. Write your Roll No. on the Question Paper.
2. Candidates should ensure that they have been provided with correct question paper. Complaints in this regard, if any should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt five (5) questions in all. Question No. one (1) is compulsory. Attempt other four (4) questions, selecting at least one question from each unit, in addition to Q.1. Marks are indicated against each question.
4. Draw the diagram wherever required.

Q.1. Answer all the following questions: (2x4=8)

- a) Why thiophene is more aromatic in nature than furan?
- b) What do you mean by step growth polymerisation?
- c) Define isoelectric point.
- d) Give the equation for the synthesis of nylon-6.

UNIT-I

- Q.2.** a) Draw molecular orbital pictures for pyrrole and pyridine. (4)
b) Write a short note on Skraup synthesis. (4)
- Q.3.** a) Giving mechanism explain the electrophilic substitution reactions of quinoline. (4)
b) Give two methods for the preparation of furan. (4)

UNIT-II

- Q.4.** a) Discuss important reactions of arenesulphonic acids. (4)
b) Starting from diethylmalonate, how will you synthesise Butanoic acid? Explain each step by giving mechanism. (4)
- Q.5.** a) Give a brief description of natural and synthetic rubbers. How vulcanisation improves the properties of natural and synthetic rubbers? (4)
b) Give preparation and uses of following polymers: (4)
a) PTFE
b) PET

UNIT-III

- Q.6.** a) Discuss briefly the methods used to determine primary structure of protein. (4)
b) Give evidence to support the dipolar structure of α -amino acids. What is the effect of pH on the structure of amino acids? (4)
- Q.7.** Write a short note on the followings: (4)
a) Solid phase peptide synthesis. (4)
b) Geometry of the peptide bond. (4)
