18HIN221 Reg. No. .....

CREDIT BASED SECOND SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

GENERAL HINDI

PAPER - II

Duration: 3 hours **Max Marks: 80**

I. एक शब्द या एक वाक्य में उत्तर लिखिए : **1×5=5**

1. "मेरा जीवन" किसकी रचना है?
2. कौन नीलकंठ के समान नहीं नाच सकती थी?
3. किसका रुतबा बढ़ रहा है?
4. किसकी पहाडी चोटियाँ शिमले से अलग है?
5. कमला कहाँ काम माँगने आयी थी?

II. अ) किन्हीं दो अवतरणों की संदर्भ सहित व्याख्या कीजिए: **2×5=10**

1. जो कुछ याद था, वह भी भूल-भाल जया था; लेकिन दूसरा उपाय ही क्या था?
2. वैसे यह कम्बख्त रोज़गार ही खराब है । बस, पकडो-पकड़ो, मारो-मारो ।
3. 'अपने हाथ एकाएक कमल कैसे हो गये? आखिर यह क्या हो गया'?

आ) किसी एक प्रश्न का उत्तर लिखिए : **1×10=10**

1. "मेरा जीवन " में दिये लेखक के विचारों को अपने शब्दों में विस्तार से लिखिए ।
2. ' कर कमल हो गये ' में व्यक्त लेखक के व्यंग्य को सारांश के साथ स्पष्ट लिखिए ।

III.अ) किन्हीं दो अवतरणों की संदर्भ सहित व्याख्या कीजिए : **2×5=10**

1. "तो उससे क्या होता है? तुमको कुछ होना ही होगा । तुम झूठ बोल रहे हो " ।
2. आपको कुछ पता नही है । यह उसका मेरे लिए ताकिया कलाम है ?
3. मुझे लगता है, मानो बरामदे की कुरसी पर मैं नहीं बैटा हूँ, केवल मेरा ओवरकोट घुन्ध की नीली दीवार पर टँगा रह गया है ?

आ) किसी एक प्रश्न का उत्तर लिखिए : **1×10=10**

1. 'चीडो पर चँदनी' यात्रावृत्तान्त को अपने शब्दों में स्पष्ट लिखिए ?
2. "कमला " कहानी का सार विस्तार से लिखिए ।

IV. अ) किन्हीं दो प्रश्नों के उत्तर लिखिए : **2×5=10**

1. क्रिया विशेषण की परिभाषा के साथ उसके भेदों को उदाहरण सहित स्पष्ट लिखिए ।
2. भूतकाल की परिभाषा लिखकर उसके चार भेदों को उदाहरण सहित लिखिए ।
3. कारक की परिभाषा लिखकर उसके चार भेदों का उदाहरण समझाइए ।

आ) वाच्य बदलिए : 1×5=5

1. सुष्मा पत्र लिख रही है ।
2. बच्चे कहानी पढ़ते हैं ।
3. तुम फूल तोडोगे ।
4. राधा ने रोटी खायी ।
5. बालक से दौडा नहीं जाता ।

V. अ) किन्हीं दो प्रश्नों के उत्तर लिखिए : 2×5=10

1. समुच्चय बोधक अव्यय की परिभाषा के साथ उसके भेदों को समझाइए ।
2. सम्बन्धबोधक अव्यय की परिभाषा लिखकर उसके भेदों को उदाहरण सहित समझाइए ।
3. विस्मयादि बोधक अव्यय की परिभाषा लिखकर उसके भेदों को सोदाहरण समझाइए ।

आ) नीचे दिये गये लोकोक्तियों का अर्थ लिखिए : 1×5=5

1. अंधी पीसे कुत्ता खाए
2. इधर कुँआ है तो उधर खाई
3. घर की मुर्गी दाल बराबर
4. एक अनार सौ बीमार
5. काँच को आँच नहीं

इ) हिन्दी में अनुवाद कीजिए : 1×5=5

1. News papers are one of the signs of civilization.
   ಸಮಾಚಾರ ಪತ್ರಿಕೆಗಳು ನಾಗರಿಕತೆಯ ಲಕ್ಷಣವಾಗಿದೆ.
2. A market is a public place where buyers and sellers meet.
   ಮಾರುಕಟ್ಟೆ, ಖರೀದಿಸುವವರಿಗೆ ಹಾಗೂ ಮಾರುವವರಿಗೆ ಒಂದು ಸಾರ್ವಜನಿಕ ಸ್ಥಳವಾಗಿದೆ.
3. To day, agriculture is diminishing.
   ಇಂದು ಕೃಷಿ ಕಡಿಮೆಯಾಗುತ್ತಿದೆ.
4. Food, clothing and shelter are the primary necessities of life.
   ಆಹಾರ, ಬಟ್ಟೆ ಮತ್ತು ವಸತಿ ನಮ್ಮ ಜೀವನದ ಪ್ರಾಥಮಿಕ ಅವಶ್ಯಕತೆಗಳಾಗಿವೆ.
5. Modern medicines cures people of many diseases.
   ನೂತನ ಔಷಧಿಗಳು ಮನುಷ್ಯನ ಅನೇಕ ಕಾಯಿಲೆಗಳನ್ನು ಗುಣಪಡಿಸುತ್ತವೆ.

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18BOT201 Reg. No. .....

CREDIT BASED SECOND SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

BOTANY

Paper II PLANT DIVERSITY –II

Time: 3 Hrs **Max. Marks: 80**

Instructions:

1. **Answer both Part A & Part B.**
2. **Answer two full questions from each unit.**
3. **All questions in Part B carry equal marks.**
4. **Draw diagrams wherever necessary.**

PART – A

1. Answer **any TEN** of the following. **10x2=20**

a) What is Rhizophore? Where do you find them?
b) Define Sorus. What type of sorus is found in *Pteris*?
c) Name the canals found in *Equisetum* stem.
d) What is protonema? Mention its significance
e) Write two characters of the division Arthrophyta
f) What are isidia? Mention their importance
g) What are liver worts? Give an example.
h) What is filmy fern? Give an example
i) What are Biocides? Give an example
j) Name the primary and secondary hosts of *Puccinia graminis*
k) Write any two symptoms of Blast disease of Rice
l) Mention any two economic importances of Bryophytes.

PART – B

UNIT – I

Answer **any TWO** of the following. **2x10=20**

2. a) Explain the thallus structure of *Rhizopus* with a neat labeled diagram. **6**
   b) Describe the pycnidial stage of *Puccinia.* **4**

3. a) Explain the structure of V.S. of lichen apothecium with a neat labeled sketch **6**
   b) Write the symptoms and management of Budrot of coconut. **4**

4. a) Explain the role of biofertilizors and in enzyme production **6**
   b) Describe the asexual reproduction in *Penicillium.* **4**

UNIT – II

Answer **any TWO** of the following. **2x10=20**

5. a) Describe the evolution of sporophyte in Bryophytes **6**
   b) Explain the antheridium in *Anthoceros* **4**

6. a) Explain the structure of sporophyte of *Psilotum* and T.S. of Synangium **6**
   b) Explain the internal features of *Riccia* thallus with a labeled diagram **4**

7. a) Explain the structure of capsule of *Funaria* **6**
   b) Write short note on **4**
      i. Solenostele
      ii. Plectostele

UNIT – III

Answer **any TWO** of the following. **2x10=20**

8. a) Explain the L.S. of strobilus of *Selaginella* with a labeled sketch **6**
   b) Give an account of the external morplology of *Equisetum* sporophyte **4**

9. a) Describe the structure of prothallus in *Pteris* **6**
   b) Explain the structure of L.S. of the spike of *Ophioglossum.* **4**

10. a) Explain the structure of T.S. of rhizome in *Marsilea* with a labeled sketch **6**
    b) Write a note on fossil fuels. **4**

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18CHE 201 Reg. No. .....

CREDIT BASED SECOND SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

CHEMISTRY

PAPER II: GENERAL CHEMISTRY

Duration: 3 hours Max marks: 80

Note: 1. Write question numbers and subdivisions clearly.
2. Write chemical equations and diagrams wherever necessary.

PART A

1. Answer any TEN of the following: 2x10=20

a) Name any two pigments used in paint.
b) The alkate metals have low ionization energy values. Give reason.
c) Alkali metal hydrides are good reducing agents. Give reason.
d) What is the role of gypsum in setting of cement.
e) State law of mass action.
f) Give any two measures which can be taken to minimize the production of hazardous and toxic waste.
g) Reaction between NO_2 and F_2 give NO_2F taken place by the following mechanism.

i) $NO_2 + F_2 \xrightarrow{slow} NO_2F + F$

ii) $NO_2 + F \xrightarrow{fast} NO_2F$

write the rate expression and order of the reaction.
h) Give any two factors affecting rate of a reaction.
i) What are nucleophiles? Give an example.
j) Picric acid is stronger acid than phenol. Give reason.
k) Give any two applications of ethylene glycol
l) What is Fries rearrangement reaction.

PART-B

UNIT-I

Answer any TWO of the following. 10x2=20

2. a) How is Portland cement manufactured? 04
b) Explain the role of Magnesium in the biosystem. 03
c) Discuss the variation of basic character of s-block elements down the group. 03

3. a) Compare the diagonal relationship between Be and Al. 03
b) Explain the variation in reducing property of s-block elements down the group and along the period in the periodic table. 03
c) How is white lead manufactured by Dutch process 04

4. a) Describe the different stages involved in the manufacture of paper. 04
b) Explain the complexation tendencies of alkali and alkaline earth metals. 03
c) Why do alkali metal impart characteristic colour to the flame. 03

UNIT-II

Answer any TWO of the following. **10x2=20**

5.	a)	Derive the rate equation for n^{th} order reaction when the initial concentration of all the reactants are same.	04
	b)	Mention any three applications of Clapeyson Clausius equation	03
	c)	Explain the green synthesis of benzoic acid from toluene.	03
6.	a)	Derive Van't – Hoff's reaction isotherm	04
	b)	Write any three principles of green chemistry.	03
	c)	The decomposition of a substance was found to be second order reaction, it takes 50 minutes for 40% completion of the reaction. Initial concentration of the reactants was 0.04M. Calculate the rate constant of the reaction.	03
7.	a)	Thermodynamically derive law of mass action.	04
	b)	How is the order of a reaction determined by differential method?	03
	c)	Calculate the heat of vapourisation of water if vapour pressure of water at 373.6K and 372.6K are respectively 1.018 atm and 0.982 atm.	03

UNIT-III

Answer any TWO of the following. **10x2=20**

8.	a)	Explain the method of manufacture of ethanol from molasses.	04
	b)	Give the mechanism of addition of HBr to propene.	03
	c)	How are phenols classified? Give an example each.	03
9.	a)	Give the mechanism of Gattermann reaction.	04
	b)	Explain the mechanism of Friedel – Craft acylation Reaction.	03
	c)	What is E_1 mechanism? Explain with example.	03
10.	a)	Explain phthalein fusion and Liebermann reaction.	04
	b)	How is chloro benzene converted to aminobenzene?	03
	c)	Explain Lucas test for distinguishing different types of alcohols.	03

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CHE201.2 Reg. No. .....

CREDIT BASED SECOND SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

CHEMISTRY

PAPER II: GENERAL CHEMISTRY

Duration: 3 hours **Max marks: 80**

Note: 1. Write question numbers and subdivisions clearly.
2. Write chemical equations and diagrams wherever necessary.

PART A

1. **Answer any TEN of the following:** **2x10=20**

a) Name any two pigments used in paint.

b) The alkate metals have low ionization energy values. Give reason.

c) Alkali metal hydrides are good reducing agents. Give reason.

d) What is the role of gypsum in setting of cement.

e) State law of mass action.

f) Give any two measures which can be taken to minimize the production of hazardous and toxic waste.

g) Reaction between NO_2 and F_2 give NO_2F taken place by the following mechanism.

i) $NO_2 + F_2 \xrightarrow{slow} NO_2F + F$

ii) $NO_2 + F \xrightarrow{fast} NO_2F$

write the rate expression and order of the reaction.

h) Give any two factors affecting rate of a reaction.

i) What are nucleophiles? Give an example.

j) Picric acid is stronger acid than phenol. Give reason.

k) Give any two applications of ethylene glycol

l) What is Fries rearrangement reaction.

PART-B

UNIT-I

Answer any **TWO** of the following. **10x2=20**

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   b) Explain the role of Magnesium in the biosystem. 03
   c) Discuss the variation of basic character of s-block elements down the group. 03

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   b) Explain the variation in reducing property of s-block elements down the group and along the period in the periodic table. 03
   c) How is white lead manufactured by Dutch process 04

4. a) Describe the different stages involved in the manufacture of paper. 04
   b) Explain the complexation tendencies of alkali and alkaline earth metals. 03
   c) Why do alkali metal impart characteristic colour to the flame. 03

UNIT-II

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	b)	Mention any three applications of Clapeyson Clausius equation	03
	c)	Explain the green synthesis of benzoic acid from toluene.	03
6.	a)	Derive Van't – Hoff's reaction isotherm	04
	b)	Write any three principles of green chemistry.	03
	c)	The decomposition of a substance was found to be second order reaction, it takes 50 minutes for 40% completion of the reaction. Initial concentration of the reactants was 0.04M. Calculate the rate constant of the reaction.	03
7.	a)	Thermodynamically derive law of mass action.	04
	b)	How is the order of a reaction determined by differential method?	03
	c)	Calculate the heat of vapourisation of water if vapour pressure of water at 373.6K and 372.6K are respectively 1.018 atm and 0.982 atm.	03

UNIT-III

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	c)	What is E_1 mechanism? Explain with example.	03
10.	a)	Explain phthalein fusion and Liebermann reaction.	04
	b)	How is chloro benzene converted to aminobenzene?	03
	c)	Explain Lucas test for distinguishing different types of alcohols.	03

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18MAT201 Reg. No. .....

CREDIT BASED SECOND SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MATHEMATICS

PAPER II: CONIC SECTIONS, SPECIAL FUNCTIONS, FOURIER SERIES, DIFFERENTIAL EQUATIONS AND NUMBER THEORY

Duration: 3 hours **Max Marks: 120**

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A **3x10=30**

1. a) Find the equation of the parabola having focus $(\frac{1}{2},0)$ and the equation of the directrix $2x+1=0$.

b) Find the vertices, foci and extremities of the minor axis of the ellipse $25x^2+4y^2=100$.

c) If $P(x,y)$ is any point on the ellipse having foci $(3,0)$ and $(-3,0)$, and extremities of the minor axis at $(0,4)$ and $(0,-4)$ prove that $|\overline{FP}|+|\overline{F'P}|=10$

d) For the curve $xy=1$, obtain an equation of the curve, after rotation of axes through an angle of $\frac{\pi}{4}$ radians.

e) Prove that $\Gamma(n+1)=n\Gamma(n)$

f) Evaluate $\int_0^\infty x^7 e^{-x^2}dx$ using gamma function.

g) Derive Fourier coefficient a_0 for the function $f(x)$ having period 2π.

h) Test the exactness of the equation $(\cos x\cos y-\cot x)\,dx-\sin x\sin y dy=0$.

i) Find the integrating factor of $y'=\cos ecx+y\cot x$

j) Find the orthogonal trajectories of the family of straight line $y=cx$.

k) Obtain a p-discriminant equation for the quadratic equation $p^2-xp-y=0$

l) Find the general solution of $y=px+p^3$.

m) If $a\mid bc$ with $\gcd(a,b)=1$, then prove that $a|c$.

n) If $\gcd(a,b)=d$ then prove that $\gcd\left(\frac{a}{d},\frac{b}{d}\right)=1$

o) Find the integer solution of $14x+35y=93$ if it exists.

PART - B

UNIT-I

2. a) Find the vertex, focus, an equation of the directrix, an equation of the axis and the length of the latus rectum of the parabola $y^2+6x+8y+1=0$. Draw a sketch of the curve. **(9)**

b) The coordinates of the foci of an ellipse are $(-8, 2)$ and $(4, 2)$ and whose length of the major axis is 18. Find the equation of the ellipse. **(9)**

3. a) Obtain an equation of the ellipse in the form $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ **(9)**

b) Simplify the equation $17x^2-12xy+8y^2-80=0$ by a rotation and translation of axes. Draw a sketch of the graph. **(9)**

UNIT-II

4. a) For $m,n>o$, prove that $\beta(m,n)=\frac{\Gamma(m).\Gamma(n)}{\Gamma(m+n)}$ **(6)**

b) Evaluate: i) $\frac{\Gamma(7)}{2\Gamma(4).\Gamma(3)}$ ii) $\int_0^\infty \frac{x^4(1+x^5)}{(1+x)^{15}}dx$ **(6)**

c) If $f(x)=x+\pi$, $-\pi<x<\pi$ and $f(x+2\pi)=f(x)$ find the Fourier coefficients a_0, a_n, b_n. **(6)**

5. a) Evaluate $\beta\left(\frac{9}{2},\frac{7}{2}\right)$ **(6)**

b) Evaluate $\int_0^{\pi/2} \cos^5\theta \sin^2\theta d\theta$ using the definition of the gamma function. **(6)**

c) Find the Fourier coefficients of the periodic function **(6)**

$$f(x)=\begin{cases}-k & :-\pi<x<0\\ k & :0<x<\pi\end{cases} \quad \text{and} \quad f(x+2\pi)=f(x)$$

UNIT-III

6. a) Solve : $ydx+(3x-xy+2)\,dy=0$ **(6)**

b) Solve: $(x+2y-1)dx+3(x+2y)\,dy=0$ **(6)**

c) Solve: $(x+2y-4)\,dx-(2x+y-5)\,dy=0$ **(6)**

7. a) Solve: $6y^2dx - x(2x^3 + y)\,dy = 0$ **(6)**

b) Solve: $xy\,dx - (x^2 + 2y^2)\,dy = 0$ **(6)**

d) Find the orthogonal trajectories of the family of curves $r = a(1 + \sin\theta)$. **(6)**

UNIT-IV

8. a) Solve $x^2p^2 + xp - y^2 - y = 0$ **(6)**

b) Find the general solution and singular solution of $2xp^3 - 6yp^2 + x^4 = 0$ **(6)**

c) Solve: $xy'' - (y')^3 - y' = 0$ **(6)**

9. a) Solve: $xyp^2 + (x + y)p + 1 = 0$ **(6)**

b) Find the general solution and singular solution of $(x^2 - 1)\,p^2 - 2xyp + y^2 - 1 = 0$ **(6)**

c) Solve: $yy'' + (y')^2 + 1 = 0$ **(6)**

UNIT-V

10. a) If a and b are integers not both which are zero, prove that there exist integers x and y such that $\gcd(a,b) = ax + by$ **(9)**

b) If a cock is worth 5 coins, a hen worth 3 coins, and 3 chicks together 1 coin, how many cocks, hens and chicks totaling 100, can be bought for 100 coins? **(9)**

11. a) i) Prove that the expression $\frac{a(a^2+2)}{3}$ is an integer, $a \geq 1$ **(4)**

ii) Find the gcd $(119, 272)$ using Euclidian Algorithm. Also find integers x and y to express in the form $\gcd(119,272) = 119x + 272y$ **(5)**

b) Prove that the Linear Diophantine equation $ax + by = c$ has a solution of and only if d|c where $d = \gcd(a,b)$. If (x_0, y_0) is a particular solution of this equation, then prove that all the other solutions are given by $x = x_0 + \left(\frac{b}{d}\right)t,\ y = y_0 - \left(\frac{a}{d}\right)t$ **(9)**

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MAT201.2 Reg. No. .....

CREDIT BASED SECOND SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MATHEMATICS

PAPER II: Number Theory & Differential Equations

Duration: 3 hours **Max Marks: 120**

Note: 1. Answer any TEN questions from Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A 10×3=30

1. a) Find the remainder when 1!+2!+.....+99!+100! is divided by 12.

b) For arbitrary integers a and b, prove that if $a \equiv b(mod n)$ then a and b leave the same remainder on division by n.

c) Using divisibility test, find whether the number 1571724 is divisible by 11 or not.

d) Find $\emptyset\,(5040)$.

e) If P is a prime then prove that $a^p \equiv a(mod p)$ for any integer a .

f) For $n > 2$, prove that $\emptyset(n)$is an even integer.

g) Prove that the Fibonacci number μ_{mn} is divisible by μ_m.

h) If x, y, z is a primitive Pythagoran triple, then prove that one of the integers x and y is even while the other is odd.

i) Express [3; 2, 1, 2, 5, 1] as a rational number.

j) Solve $y(2xy + 1)dx - xdy = 0$.

k) Find the integrating factor of the differential equation $y' = \text{cosec}\, x + y \cot x$.

l) Find the orthogonal trajectories of the family of curves $x - 4y = c$.

m) Solve the differential equation $p^2 - xp + y = 0$.

n) Solve $xyp^2 + (x + y)p + 1 = 0$.

o) For the quadratic equation $f = Ap^2 + Bp + C = 0$ show that the p – discriminant equation is $B^2 - 4AC = 0$.

PART - B

UNIT-I

2. a) State and prove fundamental theorem of Arithmetic. **(6)**

b) If $N = \sum_{k=0}^{n} a_k 10^k$ is the decimal representation of positive integer N, $0 \le a_k < 10$ and $S = a_0 + a_1 + \cdots + a_m$, then show that 9 | N if and only if 9 | S **(6)**

c) Solve the simultaneous linear congruences.

$x \equiv 1(mod\ 3)$

$x \equiv 2(mod\ 5)$

$x \equiv 3(mod\ 7)$ **(6)**

3. a) Prove that the linear congruence $ax \equiv b(mod\ n)$ has a solution if and only if d | b where $d = gcd(a, n)$. Also if d | b , then prove that it has d mutually incongruent solutions modulo n. **(6)**

b) Solve the simultaneous linear congruences.
$x \equiv 2(mod\ 3)$
$x \equiv 3(mod\ 5)$
$x \equiv 2(mod\ 7)$ **(6)**

c) If $ca \equiv cb(mod\ n)$ then prove that $a \equiv b\left(mod\ \frac{n}{d}\right)$ where $d = gcd(c, n)$ **(6)**

UNIT-II

4. a) If p is a prime and p does not divide a then prove that $a^{p-1} \equiv 1(mod\ p)$. **(9)**

b) If n is a positive integer and $gcd(a, n) = 1$ then prove that $a^{\emptyset(n)} \equiv 1(mod\ n)$ where $\emptyset(n)$ is Euler's phi function. **(9)**

5. a) Prove that the quadratic congruence $x^2 + 1 \equiv 0(mod p)$ where p is an odd prime has a solution if and only if $p \equiv 1(mod 4)$ **(9)**

b) State and prove Wilson's theorem. **(9)**

UNIT-III

6. a) Prove that the area of a Pythagorean Triangle can never be equal to a perfect square. **(6)**

b) If $m = qn + r$, then prove that $\gcd(\mu_m, \mu_n) = gcd(\mu_r, \mu_n)$. **(6)**

c) Prove that any rational number can be written as a simple continued fraction. **(6)**

7. a) Prove that the radius of the inscribed circle of a Pythagorean triangle is always an integer. **(6)**

b) For the Fibonacci sequence $\{\mu_n\}$, prove that $gcd\{\mu_m, \mu_n\} = \mu_d$ where $d = \gcd(m, n)$ **(6)**

c) Express $\frac{187}{57}$ as a simple continued fraction. **(6)**

UNIT-IV

8. a) Solve $\sin y(x + \sin y)dx + 2x^2 \cos y\, dy = 0$. **(6)**

b) Solve $(x + 2y - 4)dx - (2x + y - 5)dy = 0$. **(6)**

c) Find the orthogonal trajectories of the family of curves given by $r^2 = a \sin 2\theta$. **(6)**

9. a) Solve $y' = y - xy^3e^{-2x}$. **(6)**

b) Solve $(x + 4y - 9)dx + (4x + y - 2)dy = 0$. **(6)**

c) Find the orthogonal trajectories of the family of curves given by $r = a(1 + sin\theta)$ **(6)**

UNIT – V

10. a) Solve $xp^2 + (1 - x^2y)p - xy = o$ **(6)**

b) Find the general and singular solution of $p^2 + 4x^5p - 12x^4y = 0$. **(6)**

c) Solve: $xy'' - (y')^3 - y' = 0$. **(6)**

11. a) Solve: $x^2p^2 - 5xyp + 6y^2 = 0$. **(6)**

b) Find the general and singular solution of $p^2 + x^3p - 2x^2y = 0$ **(6)**

c) Solve: $yy'' + (y')^2 + 1 = 0$ **(6)**

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18MIC201 Reg. No. .....

CREDIT BASED SECOND SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MICROBIOLOGY- II

GENERAL MICROBIOLOGY

Duration: 3 Hours **Max Marks: 80**

Note: Draw diagrams wherever necessary.

PART A

I. Answer any TEN of the following: **10x2=20**

a) Capsule
b) Cytoplasm
c) Tinsel Flagellum
d) Capsomere
e) Bacterial Spore
f) Sandal Spike
g) Inclusions in Yeast
h) Nostoc
i) Bipolar Budding
j) TMV
k) Protoplast
l) Ray fungi

PART-B

UNIT-I

Answer any TWO complete questions of the following: **2x10=20**

II. a) Discuss about bacterial cell with a neat labelled diagram. 06
b) Write a note on Eubacteria. 04

III. a) Differentiate between Gram positive and Gram negative bacterial cell wall. 06
b) Write a note on Pili. 04

IV. a) With a neat labelled diagram explain the structure of Bacterial Flagella. 06
b) Write the functions and significance of Ribosomes and Mesosomes. 04

UNIT-II

Answer any TWO complete questions of the following: **2x10=20**

V. a) Explain the general characters and cell structure of Rickettsia. 06
b) Write a note on culturing of Mycoplasma. 04

VI. a) Write in detail about economic importance of Chlamydia. 06
b) Write a note on Lysogenic cycle of viruses. 04

VII. a) Explain the general properties of Actinomycetes. 06
b) Write a note on Bacteriophage. 04

UNIT-III

Answer any TWO complete questions of the following: **2x10=20**

VIII. a) Explain the life cycle of Entamoeba histolytica. 06
b) Write a note on types of Fungal mycelia. 04

IX. a) Discuss the life cycle of Wuchereria bancrofti. 06
b) Write a note on economic importance of Spirulina. 04

X. a) Discuss the general characters of Algae. 06
b) Write a note on production of spores in fungi 04

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18PHY201 Reg No.....

CREDIT BASED SECOND SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

PHYSICS

PAPER II: MECHANICS AND THERMAL PHYSICS

Duration: 3 Hours **Max Marks: 80**

PART –A

1. (A) Answer any TWELVE of the following. **12X1=10**

i) Define moment of inertia of a rigid body.
ii) Write the relation between angular momentum and angular velocity for a rigid body.
iii) State perpendicular axes theorem of moment of inertia.
iv) Define centre of mass.
v) What are mechanical oscillators?
vi) What is the principle of rocket propulsion?
vii) What is geostationary satellite?
viii) Define central force.
ix) Define escape velocity of a satellite.
x) Define potential energy of a particle in a conservative field.
xi) What is an adiabatic process?
xii) What does the area under P-V diagram represents?
xiii) Give Clausius statement of second law of thermodynamics.
xiv) How does boiling point of a liquid vary with temperature?
xv) How does the entropy change during reversible process?

PART-B

UNIT-I

Answer any TWO from the following: **2 X 8 = 16**

2. (a) Derive the expression for moment of inertia of a diatomic molecule.
   (b) Derive the expression for the moment of inertia of a rectangular lamina about an axis at one of its sides and about an axis passing through the centre, perpendicular to its plane. **(2+6)**

3. (a) Prove the theorem of Parallel axis of moment of inertia.
   (b) Derive the formula for moment of inertia of the flywheel, without neglecting the friction at bearing of the flywheel. **(2+6)**

4. (a) Show that centre of oscillation and centre of suspension of a compound pendulum are interchangeable.
   (b) Derive the expression for period of oscillation of a torsion pendulum. **(2+6)**

UNIT-II

Answer any TWO of the following. **2 X 8 = 16**

5. (a) Explain the principle of conservation of linear momentum.
   (b) Derive an expression for final velocity of a rocket. **(2+6)**

6. (a) Show that rate of change of angular momentum is equal to the applied torque.
   (b) Derive an expression for the areal velocity in terms of angular momentum. Show that when angular momentum is conserved, the motion of the particle is planar and transverse acceleration is zero. **(2+6)**

7. (a) Prove that simple harmonic motion is an example for central motion.
   (b) What is a conservative field? Show that in a conservative force field, work done is independent of the path. Define potential energy of a particle. **(2+6)**

UNIT-III

Answer any <u>TWO</u> of the following. **2 X 8 = 16**

8. (a) State and explain first law of thermodynamics.
   (b) Define entropy. Arrive at an expression for the entropy of a perfect gas. **(2+6)**

9. (a) If the door a refrigerator is kept open in the hall, will it make the hall warm or cool. Explain.
   (b) Derive an expression for the work done by a gas during an isothermal and adiabatic expansion. **(2+6)**

10. (a) Why does hydrogen show a heating effect in Joule-Thomson experiment?
    (b) Give the theory of Joule-Kelvin effect and hence get the expression for the temperature of inversion for a real gas. **(2+6)**

PART-C

Answer any <u>FOUR</u> of the following. **4 X 5 = 20**

11. A flywheel of mass 500 *kg* and diameter 2 *m* makes 600 revolutions per minute. Calculate the moment of inertia and energy of the flywheel.

12. The mass of a rectangular plate of length 12 *cm* and breadth 8 *cm* is 0.9 *kg*. Calculate the moment of inertia about an axis passing through i) its centre of gravity and perpendicular to the plane ii) the midpoint of length.

13. Two particles each of mass 2 *kg* are moving with velocities $2\hat{\imath} + 4\hat{\jmath}\, ms^{-1}$ and $5\hat{\imath} + 6\hat{\jmath}\, \mathrm{m}\, s^{-1}$ respectively. Find the kinetic energy of the system relative to centre of mass.

14. A 2 *kg* mass hangs from a spring. A 0.5 *kg* body suspended below it stretches it further by 3 *cm*. If 0.5 *kg* mass is removed and the mass is set into oscillation, find the time period.

15. An ideal heat engine has an efficiency of 0.2. When the temperature of the sink is increased by 25 K, the efficiency becomes 0.15. Find the temperature of the source and sink.

16. Calculate the change in entropy when 0.05 *kg* of ice at 0°C melts into water at 27°C. Assume specific latent heat of ice to be $3.36\text{X}\ 10^5\ J\ kg^{-1}$ and specific heat capacity of water is $4200\ J\ kg^{-1}K^{-1}$.

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PHY201.2 Reg No : .....

CREDIT BASED SECOND SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

Physics Theory II

Duration:3 Hrs **Max Marks:80**

PART - A

I. A. Answer any TEN from the following: **(10×1= 10 Marks)**

i. What is the physical significance of Moment of inertia?

ii. Write the relation between angular momentum and angular velocity for a rigid body.

iii. Define length of equivalent simple pendulum for a compound pendulum.

iv. What is a torsion pendulum?

v. What is the advantage of multistage rockets?

vi. Why the rifle always gives a backward kick on firing a bullet?

vii. Give an example for rotational field.

viii. What is the relation between orbital velocity and escape velocity?

ix. Write the expression for work done during adiabatic expansion of a gas.

x. What is reversible process?

xi. What is the significance of T-S diagram?

xi. What is adiabatic demagnetization?

B. Answer any FIVE of the following : **(5×2= 10 Marks)**

i Derive the expression for the MI of the rod about an axis passing through its centre and perpendicular to the rod.

ii State and prove the theorem of perpendicular axis.

iii Define certer of mass and write an expression for it in terms of mass and distance.

iv Show that Kepler's second law of planetary motion is nothing but the law of conservation of angular momentum.

v State and explain the second law of thermodynamics.

vi Why does hydrogen show a heating effect in the porous plug experiment?

PART - B

UNIT I

Answer any TWO of the following: **(2×10= 20 Marks)**

2 a) Deduce an expression for the MI of a circular disc about an axis perpendicular to its plane and hence derive the expressions for the MI of the disc about an axis passing through its diameter.

b) A uniform rectangular plate has mass 1.2 kg, length 15 cm and breadth 10 cm. Calculate the Moment of inertia about an axis passing through
a) its centre of gravity b) at one end parallel to the length. (6+4)

3. a) Describe the method for determining acceleration due to gravity and radius of gyration using a compound pendulum. Prove the necessary formula.

b) An object is suspended from one end of a cord performs a simple harmonic motion with a frequency of 0.5 Hz. If the length of the cord is increased by four times the initial length, then determine the period of harmonic motion. (6+4)

4. a) Derive the formula for Moment of Inertia used in experiment without neglecting the friction at bearings of the fly wheel.

b) A fly wheel of mass 20kg has a radius of gyration of 1.5m. Calculate its Kinetic Energy when it makes 50 rotations per minute. (6+4)

UNIT II

5. a) Write expressions for the velocities of two particles of mass m_1 and m_2 after a head on collision between them and discuss the effect i) when masses are equal, ii) when one of the mass is greater than the other iii) when one othe particle is initially at rest.

b) A constant torque of $8\hat{i} + 9\hat{j} + 10\hat{k}$ acts on a particle. If at time t = 0 the angular momentum of the particle is $5\hat{i} + 7\hat{j} + 9\hat{k}$, find the angular momentum of the particle at t = 5 s (ii) what is the magnitude of change in angular momentum of the particle? (6+4)

6. a) Derive an expression for the differential equation of a simple harmonic motion.

b) A light vertical spring extends by 25 cm for a mass of 1 kg. A body suspended from the spring oscillates with a frequency 5 Hz. Calculate the mass suspended. (6+4)

7. a) Define law of conservation of energy and show that it holds good in a conservative force field.

b) A rocket is designed to attain a maximum speed of 5.6Km/s. Mass of the rocket without fuel is 120kg. What should be the mass of the fuel?
Given: Velocity of the escaping gas = 2Km/s. (6+4)

UNIT III

8. a) State and explain first law of thermodynamics. What are its limitations? What is the physical significance of first law of thermodynamics?

b) Calculate work done, change in internal energy and heat supplied for the reversible isothermal expansion of one mole of an ideal gas at 37°C from a volume of 20 cm^3 to a volume of 30 cm^3 . (6+4)

9. a) Define entropy. Arrive at an expression for the entropy of a perfect gas.

b) 50 gms of water at 0^0C is mixed with an equal mass of water at 80^0C. Calculate the resultant increase in entropy. Specific heat of water = 4200 J kg^{-1} . (6+4)

10. a) With a diagram, explain the principle of refrigeration and derive the expression for coefficient of performance of refrigerator.

b) Calculate the temperature of inversion of helium gas.
Given a = 3.14×10^{-3} Nm^4mol^{-2},
b = $0.0247 \times 10^{-3} m^3 mol^{-1}$ and R = 8.31 $Jmol^{-1}K^{-1}$. (6+4)

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18STA201 Reg. No. .....

CREDIT BASED SECOND SEMESTER B.Sc. DEGREE EXAMINATION, AUGUST 2021

STATISTICS

PAPER II –DISTRIBUTION THEORY

Time: 3 Hrs **Max. Marks: 80**

PART - A

Answer any TEN of the following: **10X2=20**

1. a) Derive the moment generating function of Binomial distribution.

   b) State the conditions under which Binomial distribution tends to Poisson distribution.

   c) Find the mean of Geometric distribution.

   d) Find the mean and variance of $U(-1,1)$ distribution.

   e) Find the distribution function of $f(x) = \theta e^{-\theta x}, x > 0, \theta > 0$

   f) State the relation between Normal, Chisquare, t and F distribution.

   g) With a note on order statistic.

   h) Write down the p.d.f of Beta distribution of second kind.

   i) Write the mean and variance of Chi sqaure distribution with 4 degrees of freedom.

   j) State Central Limit Theorem.

   k) State Markov's and Tchebyshev's inequalities.

   l) State any two properties of Normal distribution.

PART – B

Answer any TWO of the following: **10x2=20**

2. a) Find the mean and variance of Poisson distribution.

   b) Derive the mode of Binominal distribution. **(5+5)**

3. a) Obtain the recurrence relation for the central moments of Binominal distribution.

   b) Derive the cumulants of the Poisson distribution. **(5+5)**

4. a) Derive the mean and variance of Negative Binomial distribution.

   b) Under certain condition, prove that Hypergeometric distribution tends to Binomial distribution **(5+5)**

Answer any TWO of the following: **10x2=20**

5. a) Derive the mean deviation from mean of a Normal distribution.

   b) Obtain the M.G.F of Gamma variate with parameter λ and hence find its mean and variance **(5+5)**

6. a) Find the mean and variance of Beta distribution of first kind.

   b) State and prove lack of memory property of Exponential distribution. **(5+5)**

7. a) Obtain an expression for mode of Cauchy distribution.

   b) Derive an expression for even order Central moments of Normal distribution. **(5+5)**

Answer any TWO of the following: **10x2=20**

8. a) If X and Y are independent Gamma variates with parameters m and n respectively, find The distribution of $\left(\frac{x}{x+y}\right)$

   b) If x has a uniform distribution $(0,1)$ find the distribution of $-2\log x$. **(5+5)**

9. a) Derive the density function of x^2 variate with n degrees of freedom.

   b) Show that for large degrees of freedom .t-distribution tends to standard normal distribution. **(6+4)**

10. a) If X_1 & X_2 are independent x^2 variates with n_1 & n_2 *df* respectively, then prove that $\frac{X_1}{X_2}$ is a $\beta_2(\frac{n_1}{2},\frac{n_2}{2})$ variates,

    b) If $F \sim F(n_1,n_2)$ show that $\frac{1}{F} \sim F(n_2,n_1)$. **(5+5)**

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CHE 401.2 Reg. No. .....

CREDIT BASED FOURTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

CHEMISTRY

PAPER IV: GENERAL CHEMISTRY

Duration: 3 hours **Max Marks: 80**

Note: 1. Write question numbers and subdivisions clearly.
2. Write chemical equations and diagrams wherever necessary.

PART A

1. Answer any TEN of the following: **2x10=20**

a) Write the electronic configuration of Fe^{+2} ion. How many unpaired electrons are present in it?

b) He_2 molecule does not exist. Why?

c) Write the molecular orbital configuration of F_2 molecule. What is the bond order of the molecule?

d) Sc^{+3} and Ti^{+4} ions are colourless. Why?

e) State Raoult's law for binary liquid mixture.

f) Define critical solution temperature.

g) What is physical adsorption? Give one example.

h) What is the effect of pressure and temperature on the adsorption of gas by solid?

i) Between methyl amine and aniline which is more basic and why?

j) How is methyl amine converted to methyl isocyanide? Write the chemical equation.

k) Mention any two uses of phenol-formaldehyde resin.

l) Name the monomer units of Nylon – 6, 6.

PART-B

UNIT-I

Answer any TWO of the following. **2x10=20**

2. a) Explain the energy level diagram, bond order and molecular orbital configuration of N_2 molecule on the basis of molecular orbital theory. 04

b) Explain the property of colour formation in transition elements. 03

c) Describe hybridization and shape of BF_3 based on Valence bond theory. 03

3. a) Explain the shape of ammonia and water molecule and deviation in their bond angles with the help of VSEPR theory. 04

b) Give any three differences between bonding and antibonding molecular orbitals. 03

c) Explain the complex compound formation in the case of transition elements. 03

4. a) Explain the energy level diagram, bond order and molecular orbital configuration of O_2^{-2} ion on the basis of molecular orbital theory. 04

b) Explain the general trends in any two characteristics of second and third transition series. 03

c) Write a short note on magnetic property of d-block elements. 03

UNIT-II

Answer any **TWO** of the following. **10x2=20**

5. a) Draw and explain boiling point – Composition curve for a binary liquid mixture which shows large positive deviation from Raoult's law with an example. 04

   b) Discuss Freundlich adsorption isotherm of a gas on a solid. How are the constants of this isotherm obtained? 03

   c) At a pressure of 101.3 kPa a mixture of nitrobenzene and water boils at $99^{\circ}C$. The vapour pressure of water at this temperature is 97.7kPa. Find the proportion of water and nitrobenzene in the distillate. 03

6. a) Write BET equation. How it can be used to determine the surface area of an adsorbent. 04

   b) Explain any two applications of Nernst distribution law. 03

   c) Discuss the critical solution temperature of triethyl amine-water system. 03

7. a) Explain Langmuir adsorption isotherm using mathematical expression. 04

   b) Describe vapour pressure – composition curve for non ideal solution which shows negative deviation from Raoult's law. 03

   c) What is steam distillation? What conditions should be fulfilled by the liquids for carrying out steam distillation. 03

UNIT-III

Answer any TWO of the following. **2x10=20**

8. a) How is the mixture of $1^{\circ}, 2^{\circ}$ and 3° amines separated by Hinsberg method. 04

   b) Explain the mechanism of cationic polymerization of vinyl polymer. 03

   c) Write a short note on Sandmeyer reaction. 03

9. a) What is the action of nitrous acid on primary and secondary amines. 04

   b) How do you convert benzene diazonium chloride to para-hydroxy azobenzene? 03

   c) Explain the preparation of polyurethanes and give its applications. 03

10. a) Write a note on Ziegler-Natta polymerisation. 04

    b) Explain Hoffmann bromamide synthesis of amines. 03

    c) What happens when ethyl amine reacts with acetyl chloride in the presence of concentrated H_2SO_4. 03

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MAT401.2 Reg. No. .....

CREDIT BASED FOURTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MATHEMATICS

PAPER IV: Analytical Geometry, Ring Theory and Complex Variables

Duration: 3 hours **Max Marks: 120**

Note: 1. Answer any TEN questions from Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A

10×3=30

1. a) Find an equation of the graph of $xy = 1$ w r.t. $\bar{x}$ and $\bar{y}$ axes after a rotation of axes through an angle of radian measure $\frac{\pi}{4}$.

b) Find the foci and directrices of the hyperbola $16x^2 - 9y^2 = 144$.

c) Find the eecrutricity of the conic $r = \frac{5}{4-cos\theta}$.

d) Define i) Field ii) Integral domain.

e) If every element x in a ring R satisfies $x^2 = x$, prove that R is commutative.

f) If U is an ideal of R and $1 \in U$, prove that $U = R$.

g) In $(Z, +, .)$ prove that $P = pz$ (where p is a prime) is a prime ideal.

h) Find all units in $J[i]$.

i) Prove that $f(x) = x^2 + 1$ is irreducible over the integers mod 7.

j) Find the principal arguement Argz when $z = (\sqrt{3} - i)^6$.

k) Sketch the set $|z - 1 + i| = 1$.

l) Find the domain of definition of the function $f(z) = \frac{1}{1-|z|^2}$

m) Show that $f'(z)$ does not exist anywhere for $f(z) = 2x + ixy^2$

n) Find the singular points of the function $f(z) = \frac{z^2+1}{(z+2)(z^2+2z+2)}$

o) Show that function $f(z) = \sin x \cos hy + i \cos x \sin hy$ is entire.

PART - B

UNIT-I

2. a) If B≠0 then prove that the equation $Ax^2 + Bxy + cy^2 + Dx + Ey + F = 0$ can be transformed into the equation $\bar{A}\bar{X}^2 + \bar{C}\bar{y}^2 + \bar{D}\bar{x} + \bar{E}\bar{y} + \bar{F} = 0$ when $\bar{A}$ and $\bar{C}$ are not both zero, by a rotation of axes through an angle α for which $Cot2\alpha = \frac{A-C}{B}$. **(6)**

b) Remove xy term from the equation $x^2 + 2xy + y^2 - 8x + 8y = 0$ by a rotation of axes. Draw a sketch of the graph and show both sets of axes. **(6)**

c) An equation of a conic is $r = \frac{2}{1-cos\theta}$. Find the eccentricity, identify the conic, write an equation of the directrix corresponding to the focus at the pole, find the vertices, and draw a sketch of the curve. **(6)**

3. a) If (x, y)represents a point P with respect to a given set of axes and $(\overline{x}, \overline{y})$ is a representation of P after the axes have been rotated through an angle α then prove that $x = \overline{x}\,cos\alpha - \overline{y}sin\alpha$ and $y = \overline{x}sin\alpha + \overline{y}cos\alpha$. **(6)**

b) Simplify the equation $x^2 + xy + y^2 - 3y - 6 = 0$. Draw a sketch of the graph of the equation and show both of axes. **(6)**

c) A parabola has its focus at the pole and its vertex at $(4, \pi)$. Find an equation of the parabola in polar form and an equation of the directrix. Draw a sketch of the parabola and the directrix. **(6)**

UNIT-II

4. a) If R is a commutative ring with unit element whose only ideals are (0) and R itself. Show that R is a field. **(6)**

b) $If\ \emptyset: J\sqrt{2} \to J\sqrt{2}$ is defined by $\emptyset(m + n\sqrt{2}) = m - n\sqrt{2}$. Prove that $\emptyset$ is homomorphism and find its kernel. **(6)**

c) Let U be an ideal of R and $r(U) = \{x \in R/xu = 0\ for\ all\ u \in U\}$. Prove that r (U) is an ideal of R. **(6)**

5. a) Prove that a finite integral domain is a field. **(6)**

b) If U and V are ideals of a ring R then prove that $U + V = \{u + v | u \in U\ and\ v \in V\}$ is an ideal of R. **(6)**

c) Define 'maximal ideal'. Prove that kernel of homomorphism is an ideal. **(6)**

UNIT-III

6. a) Let R be the ring of integers and p be a prime number. Prove that $P = (p)$ is a maximal ideal of R. **(6)**

b) If $f(x)$ and $g(x)$ are two non-zero elements of $F[x]$, then prove that $deg[f(x).g(x)] = degf(x) + \deg g(x)$. **(6)**

c) Let R be a Euclidean ring and $a, b \in R$. If $b \neq 0$ is not a unit in R then prove that $d(a) < d(ab)$ **(6)**

7. a) Let R be a Euclidean ring and let A be an ideal. Prove that there exists an element $a_0 \in A$ such that $A = \{a_0 x | x \in R\}$. **(6)**

b) If p is a prime number of the form 4n+1 then prove that $p = a^2 + b^2$ for some integers a and b. **(6)**

c) Let R be a Euclidean ring. Then prove that every element in R is either a unit in R or can be written as the product of finite number of prime elements of R. **(6)**

UNIT-IV

8. a) Establish by $\in -\delta$ definition $\lim_{z\to 1} \frac{iz}{2} = \frac{i}{2}$ in the open disc $|z| < 1$. **(6)**

b) If $f(z) = u(x, y) + iv(x, y), z = x + iy, z_0 = x_0 + iy_0$ and $w_0 = u_0 + iv_0$ then prove that $\lim_{z\to z_0} f(z) = w_0$ if and only if $\lim_{(x,y)\to(x_0,y_0)} u(x,y) = u_0$ and $\lim_{(x,y)\to(x_0,y_0)} v(x,y) = v_0$ **(6)**

c) Using C – R equations show that $f'(z)$ exists for $f(z) = e^z$ **(6)**

9. a) Find all the values of $(-8i)^{\frac{1}{3}}$. **(6)**

b) If $f(z) = \frac{z}{\bar{z}}$, then show that $\lim_{z \to 0} f(z)$ does not exist. **(6)**

c) If $f(z) = 3\sqrt{r}\, e^{\frac{i\theta}{3}}, (r > 0)$ find $f'(z)$ by using C – R equations in Polar form. **(6)**

UNIT – V

10. a) If $u(x, y) = 2x(1 - y)$, then show that $u(x, y)$ is harmonic in some domain and find its harmonic conjugate. **(6)**

b) Show that function $f(z) = u(x, y) + iv(x, y)$ is analytic in a domain D if and only if v is a harmonic conjugate of u. **(6)**

c) If m and n are integers find the value of $\int_0^{2\pi} e^{im\theta}\, e^{-in\theta}\, do$. **(6)**

11. a) Show that $u(x, y)$=2x-$x^3 + 3xy^2$ is harmonic in some domain and find a harmonic conjugate $v(x, y)$. **(6)**

b) If a function $f(z) = u(x, y) + iv(x, y)$ is analytic in a domain D then prove that its components u and v are harmonic in D. **(6)**

c) Evaluate $\int_C \frac{z+2}{z}\, dz$ where C is the semicircle $z = 2e^{i\theta}, (0 \leq \theta \leq \pi)$. **(6)**

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PHY 401.2 Reg. No.----------

CREIDT BASED FOURTH SEMESTER B.Sc DEGREE EXAMINATION

AUGUST2021

PHYSICS

PAPER-IV: ELECTROMAGNETISM AND ELECTRICITY

Time: 3 Hrs Max. Marks: 80

PART – A

I.A. Answer any TEN of the following 10 x 1 = 10

i. What is a vector point function??
ii. What is a solenoidal vector?
iii. What is the angle between electric and magnetic vector in an electromagnetic wave?
iv. What is Laplacian operator?
v. State Kirchoff's voltage law.
vi. Write the condition for maximum to be transferred to the load.
vii. Give the expression for frequency of oscillation in a LCR circuit.
viii. What is transient current?
ix. Write the condition for resonance of series LCR circuit.
x. Draw the frequency curve for a band pass filter.
xi. Draw the diagram for Star configuration.
xii. How is damping reduced in a BG?

B. Answer any FIVE of the following 5 x 2 = 10

i. State Guass theorem and express it in vector form.
ii. Derive the equation of continuity.
iii. Explain how Norton's equivalent is obtained from Thevenin's equivalent by source transformation.
iv. Show that CR has the dimension of time.
v. Deduce the expression for mean value of alternating current.
vi. Draw the labelled diagram of a BG.

PART B

UNIT I

Answer any TWO of the following

1. a) Prove the law of energy of electromagnetic wave using Poynting theorem.
   b) If $\phi = 3x^2y - y^3z^2$ find $\nabla\phi$ and $|\nabla\phi|$ at $(1, -2, -1)$ (6 + 4)

2. a) Deduce Maxwell's field equation $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ with usual symbols.
   b) Prove that $\vec{A} = 3y^2z\,\hat{i} + 4x^3z^2\hat{j} + 3xy\,\hat{k}$ is solenoidal. (6 + 4)

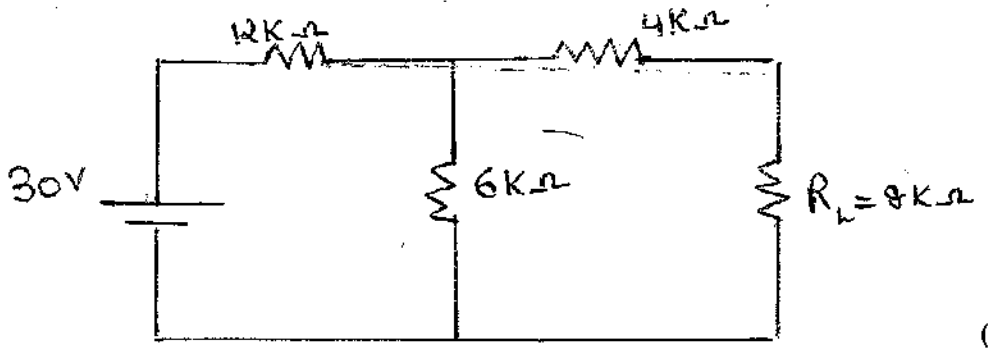
3. a) Using Maxwell's field equations show that electromagnetic waves are transverse in nature.
   b) Find $\nabla.(\nabla\vec{\varphi})$ if $\vec{\varphi} = 2x^3y^2z^4$ (6 + 4)

UNIT II

Answer ant TWO of the following

5. a) With a general network explain steps involved in finding the branch currents using mesh current network.

b) Obtain the Thevenin equivalent circuit for the network given below and also calculate the current through the load resistance.



(6 + 4)

6. a) Derive an expression for the growth of charge in a CR circuit and define time constant

b) A dc voltage of 80V is switched on to a circuit containing a resistance of 5 Ω in series with an inductance of 20H. Calculate the rate of growth of current at the instant when the current is (i) 6A and (ii) 16A (6 + 4)

7. a) Obtain an expression for the charge on the capacitor when it is charged through series LCR circuit.

b) In an oscillatory circuit L = 0.2 H, C = 0.001 μF. What is the maximum value of the resistance so that the circuit may oscillate? (6 + 4)

UNIT III

Answer ant TWO of the following

8. a) Draw the series LCR circuit and explain the sharpness of resonance curves in terms of resistance and hence define selectivity.

b) An AC circuit consists of a coil of resistance 15 Ω and reactance ωL = 20 Ω and is worked off at 200 V, 50 Hz supply. Find the value of current and angle of lag.

(6 + 4)

9. a) Give the theory of Anderson's bridge by drawing necessary diagram.

b) Calculate the cut off frequency for a simple high pass filter consisting of an 0.1μF capacitor connected in series with a 1500 KΩ resistor. (6 + 4)

10. a) Define line and phase voltages Show that line current is $\sqrt{3}$ times the phase current in delta configuration

b) A capacitor charged to 2 V is discharged through a BG when the corrected deflection is 9.6 cm and the current sensitivity is 454 μA/cm and the time period is 12 s. Calculate the capacity of the capacitor. (6 + 4)

18BOT601

Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

BOTANY

Botany Theory VII

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. Write any four applications of Callus culture.
2. Differentiate symmetric and asymmetric hybrids.
3. Define Biotechnology. Mention its significance.
4. What is cDNA?
5. Mention the bacterial species used in te industrial synthesis of Vit B_{12}.
6. What is chaptelization? What is it significance?

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. Elaborate on i) Nutrient media ii) Solidifying agent
8. Give the contribution of the following scientists in Biotechnology:
   i) Baltimore ii) Went iii) Guha and Maheshwari iv) Skoog and Miller
   v) Murashige and skoog vi) Steward
9. Explain Type II and Type III restriction enzymes.
10. Write a note on: i) IED cells and PED cells ii) Encapsulation of embryos
11. Write a note on: i) Edible vaccines ii) Biodegradable plastics
12. Explain the controversies observed in Genetically Modified crop production and consumption. Add a note on GM Rice.

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Describe the *In-vitro* responses of explants in plant tissue culture.
14. Elaborate the process of Micropropagation with stem as an explant.
15. Write a note on:
    i) Hazard ii) LT B iii) Erwinia uredovora iv) Limitation of time v) Biosafety
16. What are the tehniques used to screen the transformed cells? Describe them.
17. Describe the mechanism of Pest resistance by Genetically engineered Bt toxin and Cowpea trypsin.

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18BOT612 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021
BOTANY
Botany Theory VIII

Duration:3 Hours Max Marks:80

I. Answer any FIVE of the following : (5×2= 10 Marks)

1. What are mesophytes? Give an example.
2. State the laws in which ecosystem is governed.
3. What are degradable non degradable pollutants?
4. What is ecesis? Mention the type of processes.
5. Mention any two effects of soil erosion.
6. Define 't' test. Where it is used?

II. Answer any FIVE of the following : (5×6= 30 Marks)

7. What is Pyramid of Number? Mention its types with examples.
8. Write note on negative interactions of biotic factors.
9. Write a note on Moist deciduous and tropical evergreen forests.
10. Explain Reed swamp and Sedge medow stage in hydrospere.
11. What is biogas? Add anote on the parts of biogas plants.
12. What is biodiversity? Explain their types.

III. Answer any FOUR of the following : (4×10= 40 Marks)

13. Explain in detail about soil profiling.
14. Explain the effect of Temperature on vegetation.
15. Describe the vegetation types of Dakshina Kannada.
16. What are renewable (Alternate) energy sources? Mention the different types with examples.
17. What is IUCN? Mention the different threat categories of plants and add a note on Endemic plants of India.

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18CHE601 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

CHEMISTRY

Chemistry Theory VII

Duration:3 Hours **Max Marks:80**

I. Answer any SEVEN of the following : **(7×2= 14 Marks)**

1. What are high spin complexes? Give an example.
2. What are simple and mixed organometallic compounds? Give an example for each.
3. Calculate the value of einstein of energy for radiation of $4000A^0$.
4. KCl is employed in the preparation of a salt bridge. Why?
5. Explain the aromatic character of thiophene using Huckel's rule.
6. What is the condition for a molecule to be IR active?
7. What is trans effect ? Among Cl and NH_3 which has more trans directing effect?
8. Calculate the EMF of the cell which involves the following reaction.
   $Zn + 2Ag^+ \rightarrow Zn^{2+} + 2Ag$. Given $E^0_{Zn^{2+},Zn^+} = -0.76V$; $E^0_{Ag^+,Ag} = +0.80V$

II. Answer any SIX of the following : **(6×6= 36 Marks)**

9. Explain two applications each of complexes in i) qualitative analysis ii) gravimetric analysis. (6)
10. a. Derive the relationship between standard free energy change and equilibrium constant for a cell reaction. (3)
    b. Calculate the free energy change of the following cell at 25^0C:
    Sn/Sn^{2+} (0.5M) // Pb^{2+} (0.3M) / Pb. Given: standard EMF of the cell is 0.014V.(3)
11. a. How do you convert furan into- i) furfural ii) thiophene. (3)
    b. Give a reaction to show that furan behaves as a diene. (3)
12. a. Write a note on selection rules for d-d transitions. (3)
    b. Obtain spectroscopic ground state term symbol for d^2 and d^{10} configuration. (3)
13. Explain the principle of i) nuclear reactor ii) solar photovoltaic cell. (6)

14. a. Give the mechanism of electrophilic substitution reaction of pyridine. (3)

b. Give any two nucleophilic substitution reactions of pyridine. (3)

15. a. Give three reactions of alkyl lithium compounds. (3)

b. Give three reactions of alkyl aluminium compounds. (3)

III. Answer any THREE of the following : **(3×10= 30 Marks)**

16. a. Explain different magnetic properties of complexes with examples. (5)

b. Give five applications of magnetic moment data. (5)

17. a. How will you determine the solubility and solubility product of sparingly soluble salts from EMF measurement? (5)

b. Illustrate with an example the determination of the valency of the ions from EMF measurement? (5)

18. a. Explain Bischler-Napieralski synthesis of isoquinoline. (4)

b. Explain Skraup synthesis of quinoline. (4)

c. Give any one electrophilic substitution reaction of indole. (2)

19. a. Give any two general methods of synthesis of pyrrole. (4)

b. Explain the molecular orbital picture of pyrrole and justify its aromatic character. (6)

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CHE 601.2 Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

CHEMISTRY

PAPER VII: GENERAL CHEMISTRY

Duration: 3 hours **Max Marks: 80**

Note: 1. Write question numbers and subdivisions clearly.
2. Write chemical equations and diagrams wherever necessary.

PART A

1. Answer any TEN of the following: **10x2=20**

a) What are organometallic compounds? Give one example.
b) Calculate the spin only magnetic moment for Cr (Z=24)
c) What are Labile Complexes? Give an example.
d) What is spectrochemical series? Give the sequence of spectrochemical series.
e) What are concentration cells? Mention the types.
f) What is decomposition potential?
g) State Beer –Lamberts law. Give the mathematical equations.
h) What is nuclear fusion? Give an example.
i) What happens when pyridine is treated with $NaNH_2$?
j) How do you convert thiophene to n – butane?
k) What is motar absorptivity?
l) What is chemical shift in NMR spectroscopy?

PART-B

UNIT-I

Answer any TWO of the following. **2x10=20**

2. a) How do you obtain the following compounds starting with Organo lithium compounds? 04
i) Acetone ii) t – butyl alcohol.
b) Derive the spectroscopic ground states for d^1,d^2 and d^{10} systems. 03
c) Explain any three factors affecting the stability of complexes. 03

3. a) Explain how magnetic susceptibility is determined by Gouy balance? 04
b) Give three properties of Organoaluminium Compounds. 03
c) What are the limitations of valence bond theory? 03

4. a) Write a note on charge transfer speetva 04
b) Explain the applications of magnetic moment data for 3d complexes. 03
c) Explain the structure of $Al_2(CH_3)_6$ 03

UNIT-II

Answer any **TWO** of the following. **2x10=20**

5. a) Describe the construction and working of quinhydrone electrode 04
   b) Explain chemiluminescence with example. 03
   c) Explain the principle of nuclear reactor. 03

6. a) Explain the construction and working of a hydrogen – oxygen fuel cell. 04
   b) A certain system absorbs $3x10^{18}$ quanta of light per second on irradiation for 30 minutes, $3x10^{-3}$ moles of the reactant reacted. Calculate the quantum yield. 03
   c) Explain the principle of solar photo voltaic cell. 03

7. a) Explain the determination of strength of ferrous solution by potentiometric method. 04
   b) Distinguish between fluorescence and phosphorescence. 03
   c) Explain the determination of pH of a solution using glass electrode by potentiometric method. 03

UNIT-III

Answer any TWO of the following. **2x10=20**

8. a) Explain the IR spectrum of 04
      i) Benzaldehyde ii) Cyclopentanone
   b) Explain the splitting (spin – spin coupling) of a NMR signal 03
   c) Explain Bischler – Napieralsky synthesis of iso quinoline. 03

9. a) Explain the terms :- 04
      Bathochromic Shift, Hypsochromic Shift, Hyperchromic Shift, Hypochromic Shift.
   b) Explain Fischer – Indole synthesis 03
   c) Write notes on finger print region 03

10. a) Describe the applications of mass spectrometry. 04
    b) Pyridine is more basic than pyrrole, why? 03
    c) Explain NHR spectrum of 2,2 – dimethyl propane. 03

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18CHE612 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

CHEMISTRY

Chemistry Theory VIII

Duration:3 Hours **Max Marks:80**

I. Answer any SEVEN of the following : **(7×2= 14 Marks)**

1. Define i) absolute error ii) relative error.
2. Define titrant and analyte.
3. Distinguish between equivalence point and end point in a titration.
4. Write the principle of Parke's process of desilverisation of lead.
5. Mention two sources of soil pollution.
6. Draw Ellingham's diagram.
7. What are indirect fertilizers? Give an example.
8. What is Parathion and how is it prepared?

II. Answer any SIX of the following : **(6×6= 36 Marks)**

9. a) Explain the principle of gas - liquid chromatograpy. (3)
   b) Explain the applications of thin layer chromatography. (3)
10. a) Explain the principle of atomic absorption spectroscopy. (3)
    b) Write the applications of differential thermal analysis (DTA) (3)
11. a) Explain the purification of copper by electrolytic process. (3)
    b) Explain extraction of lead by carbon reduction process. (3)
12. a) Define DO of water. Explain how is it determined. (3)
    b) Write a note on soil pollution. (3)
13. a) What are food preservatives? What are class I and class II preservatives ? Give one example for each. (3)
    b) What are sweeteners? Mention different types with examples. (3)

14. a) Explain the production of methanol. (3)

b) Mention the raw materials for polythene and give two applications of polythene. (3)

15. a) Explain pasteurisation of milk. (3)

b) Explain the preservation of fruits. (3)

III. Answer any THREE of the following : **(3×10= 30 Marks)**

16. a) In a set of measurements the following concentrations of Mg (ppm)were reported : 15.3, 15.1, 15.7, 15.0, 15.4, 15.8, 15.2, 15.9 Calculate i) Mean deviation ii) standard deviation iii) coefficient of variance (5)

b) Write the rules for identifying the number of significant figures with an example for each. (5)

17. a) Mention any five types of ores and give one example for each. (5)

b) Explain i) magnetic separation ii) Gravity separation during metallurgy. (5)

18. a) Explain the norms set by AGMARK . (5)

b) Explain canning method of preservation. (5)

19. a) Write a short note on i) Fuel Cell Vehicles ii) Fuel used in racing cars. (5)

b) Explain the production of butadiene from petrochemicals. (5)

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CHE 602.2 Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

CHEMISTRY

PAPER : Elective-2: BIOLOGICAL CHEMISTRY

Duration: 3 hours **Max Marks: 80**

PART A

1. Answer any TEN of the following: **10x2=20**

a) What are alkaloids? Give one example.

b) What is isoprene rule?

c) How do you show that citral has $\alpha_1\ \beta$ unsaturated aldehydic group?

d) Give any two uses of barbituric acid.

e) What are drug analogs?

f) What is tailoring of drug?

g) Give the structure of sulphanilamide.

h) Explain the term "drug affinity".

i) Name the disease caused by the deficiency of vitamin B.

j) What is renaturation of proteins?

k) Write the general formula of a dipeptide.

l) What are trace elements?

PART-B

UNIT-I

Answer any **TWO** of the following. **2x10=20**

2. a) How is $O-CH_3$ group estimated in an alkaloid. 03

b) Give the classification of terpenoids with examples. 03

c) Write the synthesis of the following

(i) uracil (ii) purine 04

3. a) What are the general characteristic properties of alkaloids? 03

b) Give the synthesis of caffeine. 03

c) Discuss the constitution of menthol. 04

4. a) Explain Hoffmann's exhaustive methylation with an example. 03

b) How is the position of the double bond established in citral? 03

c) Discuss the constitution of nicotine. 04

UNIT-II

Answer any **TWO** of the following. **2x10=20**

5. a) What is elimination of drugs? What are the factors affecting the metabolism of drugs? 03

b) Give the synthesis of chloramine-T. 03

c) Write short notes on the following

(i) potency (ii) Therapeutic index 04

6. a) Explain the stages of drug metabolism. 03
   b) Write the synthesis of sulphanilamide. 03
   c) Write short notes on the following.
      (i) Prodrugs (ii) Enzyme inhibitors 04

7. a) Explain the concept of drug receptor taking g-protein as an example. 03
   b) Write the synthesis of paracetamol. 03
   c) Write a brief note on
      (i) Biosensors (ii) Enzymes as drugs. 04

UNIT-III

Answer any <u>TWO</u> of the following. **2x10=20**

8. a) Give Gabriel Phthalimide synthesis of α – amino acids. 03
   b) Write the structural difference between chlorophyll – a and chlorophyll-b and explain their importance. 03
   c) Give the synthesis of vitamin A. 04

9. a) Give an account of the biological importance of sodium and potassium. 03
   b) Explain the classification of vitamins with examples. 03
   c) Describe one method each for the determination of C-terminal and N-terminal amino acids. 04

10. a) Describe chemical properties of amino acids. 03
    b) Write the synthesis of vitamin C. 03
    c) Write a note on polypeptide synthesis with reference to solid phase method. 04

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18COS601 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

COMPUTER SCIENCE

Computer Science Theory VII

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. How do you include single line comments in python? Give one example.
2. Write the syntax of while loop in python.
3. What are local variables in python? Give an example.
4. What is user defined function in python?
5. How do you create a class & object in Python?
6. How do you connect Python to mysql database?

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. What are the features of python? Explain.
8. Explain the continue statement with example.
9. a) Explain loop through a tuple.
   b) How can you check if a specified item exists in a tuple?
10. Explain format() method how to add formatting type Inside the placeholders .
11. Explain with example super() function.
12. Explain the strftime() method with example.

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Explain sets in python.
14. a) Compare Java and Python.
    b) Compare C and Python.
15. Explain with example difference between a normal def defined function and lambda function.
16. Explain with example inserting rows into a table through python.
17. a) Explain the tasks performed by Python Interpretor to execute a Python Program
    b) Explain garbage collection in Python .

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18COS612 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021
COMPUTER SCIENCE
Computer Science Theory VIII

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. What is view state?
2. What do you mean by cross page posting?
3. Write any two properties of RangeValidator control.
4. List the different templates of LoginView control.
5. Write any two advantages of Master page.
6. Write a note on ImportCatalogPart.

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. Explain the history of web applications.
8. Mention the steps involved in creating a ASP.NET website.
9. What are Button server controls? Explain any two types.
10. Explain AdRotator server control with the help of an example.
11. Write a note on i) SqlDataSource control ii) AccessDataSource control
12. Write a note on i) GridView control ii) Repeater control

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Explain a) Code Sharing Model
    b) Compilation Model
14. a) What is a server control? Explain its types.
    b) Write a note on Intellisense feature of coding server control.
15. Explain a) CheckBox server control
    b) RadioButton server control
16. Explain i) ImportCatalogPart ii) EditorZone iii) LayoutEditorPart
17. Explain the structure of ASP.NET web application.

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COS603.3

Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

COMPUTER SCIENCE

Paper VIII : Micro Processor Architecture and 8086 Programming

Time: 3 Hrs **Max. Marks: 80**

PART – A

1. **Answer any TEN questions from the following:** **2x10=20**

a) What is an instruction code and operation code?

b) What is an interrupt cycle?

c) Expand: i) RISC ii) CISC

d) When does the carry flag and zero flat set to 1?

e) Give an example to Indirect addressing mode and Register relative addressing mode.

f) Name the segment registers.

g) What is the purpose of LABEL directive?

h) Differentiate ADD and ADC instruction.

i) Mention any four processor control instructions.

j) How does the Loop instruction works?

k) What is the difference between LAHF and SAHF instruction?

l) What is reverse polish notation?

PART – B

Answer any TWO full questions from each unit.

UNIT – I

2. a) With diagram, explain common bus system. **(6)**

   b) Write a note on implied mode and immediate mode. **(4)**

3. a) With a neat diagram, explain control unit of a basic computer system. **(6)**

   b) Explain: i) One – address instruction **(4)**
   ii) Three – address instruction

4. a) Explain the major types of interrupts that cause a break in the normal execution of a program. **(6)**

   b) Write a note on instruction cycle. **(4)**

UNIT – II

5. a) Explain Bus interface unit and Execution unit of a 8086 microprocessor **(6)**

   b) Write the purpose of the following directives. **(4)**
   i) ASSUME ii) ORG iii) OFFSET iv)EQU

6. a) Explain : i) Direct addressing mode **(6)**
   ii) Register addressing mode
   iii) Based indexed mode.

   b) Explain the general purpose registers. **(4)**

7. a) Explain with examples : DB, DW and DD **(6)**

   b) Explain pointer and index registers. **(4)**

UNIT - III

8. a) Explain different Rotate instructions **(6)**

   b) How does an interrupt work? **(4)**

9. a) Explain with example MUL and DIV instruction **(6)**

   b) Explain any two string instructions. **(4)**

10. a) Explain any three Exception interrupts **(6)**

    b) Explain the instructions: XCHG, LEA, SUB and NEG **(4)**

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18MAT601 Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MATHEMATICS

PAPER VII: Partial Differential Equations, Vector spaces and Series.

Duration: 3 hours **Max Marks: 120**

Note: 1. Answer any TEN questions from Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A **10×3=30**

1. a) Solve the differential equation. $(yz + xyz)\,dx + (zx + xyz)dy + (xy + xyz)dz = 0$ by rearranging the terms.

b) Obtain the partial differential equation of all planes having equal x and y intercepts.

c) Solve : $\frac{z}{pq} = \frac{x}{q} + \frac{y}{p} + \sqrt{pq}$

d) Prove that the vectors (1, 1, 0, 0) (0, 1, -1 0) and (0, 0, 0, 3) in R^4 are linearly independent over R.

e) If V is finite dimensional then prove that any two bases of V have same number of elements.

f) V is a vector space over F and W is a subspace of V. Define orthogonal complement $W^{\perp}$ of W and prove that it is a subspace of V.

g) Find the matrix which represents the linear transformation T with T(1, 0) = (0, 1), T(0, 1) = (3, 2). Also find T(x, y).

h) Prove that the sum of two linear transformations is linear.

i) Prove that the range of a linear transformation T: V→W is a subspace of W.

j) Determine whether the infinite series $\sum_{n=1}^{\infty} \frac{1}{(n^2+2)^{1/3}}$ is convergent or divergent.

k) Determine if the sequence $\left\{\frac{n^2+1}{n^2}\right\}$ is convergent or divergent.

l) Use integral test to determine if the series $\sum_{n=2}^{\infty} \frac{1}{n\sqrt{\ln n}}$ is convergent or divergent.

m) Determine whether the series $\sum_{n=1}^{\infty} \frac{\cos^2 n}{3^n}$ is convergent or divergent.

n) Prove that the series $\sum \frac{(-1)^{n+1}}{n}$ is conditionally convergent.

o) Determine if the alternating series $\sum_{n=1}^{\infty} \frac{1}{[\ln (n+1)]^n}$ is convergent or divergent.

PART - B

UNIT-I

2. a) Assuming the condition of integrability solve $(2x + y^2 + 2zx)dx + 2xydy + x^2dz = 0$. (6)

   b) Solve $p(1 + q) = qz$ (6)

   c) Solve $p^2 - y^3q = x^2 - y^2$ (6)

3. a) Solve $(3z - 4y)p + (4x - 2z)q = 2y - 3x$ (6)

   b) Solve $p^2 + q^2 = npq$ (6)

   c) Solve $p(1 + q^2) = q(z - a)$ (6)

UNIT-II

4. a) If $\{v_1, v_2, \ldots v_n\}$ is a basis of V and $\{w_1, w_2, \ldots w_m\}$ are linearly independent in V then prove that $m \leq n$. (6)

   b) If V is a vector space over F and W is a subspace of V then prove that

   $$dim\, V/W = dimV - dimW.$$ (6)

   c) If V is finite dimensional inner product space and W is a subspace of V when prove that V is the direct sum of W and $W^{\perp}$. (6)

5. a) V is a vector space over F. For any nonempty subset S of V define L(S), the linear span of S. Prove that L(S) is a subspace of V . (6)

   b) V is a vector space over F. Prove that the vectors $\{v_1\, v_2 \ldots\ldots v_n\}$ in V are linearly independent or some v_k is a linear combination of its proceeding ones. (6)

   c) If V is an inner product space over F, for any u, v ∈ V prove that $|(u, v)| \leq \|u\|\|v\|$. (6)

UNIT-III

6. a) Define the linear transformation of a vector space V into W. Prove that the product of two linear transformations of V into V is linear. (6)

   b) Prove that a linear transformation T of a vector space V with basis α_1, $\alpha_2, \ldots\ldots \alpha_n$, is nonsingular if and only if the vectors α_1T, $\alpha_2T, \ldots\ldots \alpha_nT$, are linearly independent in V. When this is the case, prove that T has a two sided inverse T^{-1} such that $TT^{-1} = T^{-1}T = I$. (6)

   c) Find the inverse of the matrix $\begin{pmatrix} 1 & 0 & 3 \\ 2 & 4 & 1 \\ 1 & 3 & 0 \end{pmatrix}$ using linear transformations. (6)

7. a) If $\{\beta_1, \beta_2 \ldots\ldots \beta_m\}$ is any basis of a vector space V and $\{\alpha_1, \alpha_2 \ldots\ldots \alpha_m\}$ are any m vectors in W. Prove that there is one and only one linear transformation of V into W such that $T(\beta_1) = \alpha_1, T(\beta_2) = \alpha_2 \ldots\ldots T(\beta_m) = \alpha_m$ (6)

   b) If the linear transformation $T: V \to W$ is a one-one transformation of V onto W prove that T^{-1} is linear. (6)

   c) Find the inverse of the matrix $\begin{pmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix}$ using linear transformation. (6)

P.T.O.

UNIT-IV

8. a) Prove that a bounded monotonic sequence is convergent. (6)

   b) If the series $\sum_{n=1}^{\infty} u_n$ is convergent then prove that $\lim_{n\to\infty} u_n = 0$. Hence prove that the series $\sum_{n=1}^{\infty} \frac{n^2+1}{n^2}$ is divergent. (6)

   c) Prove that the series $\sum \frac{1}{n!}$ is convergent. (6)

9. a) Using the definition prove that the sequence $\frac{n}{2n+1}$ has the limit $\frac{1}{2}$. (6)

   b) Let the series $\sum_{n=1}^{\infty} u_n$ be a series of positive terms. If $\sum v_n$ is a series of positive terms that is known to be convergent and $u_n \leq v_n$ for all positive integers n. Then prove that $\sum_{n=1}^{\infty} u_n$ is convergent. (6)

   c) Prove that a convergent monotonic sequence is bounded. (6)

UNIT – V

10. a) Prove that the alternating series $\sum_{n=1}^{\infty}(-1)^{n+1} a_n$ where $a_n > 0$ is convergent if $a_{n+1} < a_n$ and $\lim_{n\to\infty} a_n = 0$. (6)

    b) Determine if the following series is convergent or divergent : $\sum_{n=1}^{\infty} \frac{4}{3^n+1}$ (6)

    c) Determine if the following series is convergent or divergent : $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n^2+4n}}$ (6)

11. a) Test for convergence of the series $\sum_{n=1}^{\infty}(-1)^{n+1} \frac{n}{2^n}$. (6)

    b) Test for convergence of the series $\sum_{n=1}^{\infty}(-1)^n \frac{3^{2n+1}}{n^{2n}}$ by root test. (6)

    c) Test for convergence of the series $\sum(-1)^n \frac{n!}{2^{n+1}}$ by ratio test. (6)

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MAT601.1 Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MATHEMATICS

PAPER VII: Partial Differential Equations, Vector spaces and Series.

Duration: 3 hours **Max Marks: 120**

Note: 1. Answer any TEN questions from Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A 10×3=30

1. a) Solve the differential equation. $(yz + xyz)\,dx + (zx + xyz)dy + (xy + xyz)dz = 0$ by rearranging the terms.

b) Obtain the partial differential equation of all planes having equal x and y intercepts.

c) Solve : $\frac{z}{pq} = \frac{x}{q} + \frac{y}{p} + \sqrt{pq}$

d) Prove that the vectors (1, 1, 0, 0) (0, 1, -1 0) and (0, 0, 0, 3) in R^4 are linearly independent over R.

e) If V is finite dimensional then prove that any two bases of V have same number of elements.

f) V is a vector space over F and W is a subspace of V. Define orthogonal complement $W^{\perp}$ of W and prove that it is a subspace of V.

g) Find the matrix which represents the linear transformation T with T(1, 0) = (0, 1), T(0, 1) = (3, 2). Also find T(x, y).

h) Prove that the sum of two linear transformations is linear.

i) Prove that the range of a linear transformation T: V→W is a subspace of W.

j) Determine whether the infinite series $\sum_{n=1}^{\infty} \frac{1}{(n^2+2)^{1/3}}$ is convergent or divergent.

k) Determine if the sequence $\left\{\frac{n^2+1}{n^2}\right\}$ is convergent or divergent.

l) Use integral test to determine if the series $\sum_{n=2}^{\infty} \frac{1}{n\sqrt{\ln n}}$ is convergent or divergent.

m) Determine whether the series $\sum_{n=1}^{\infty} \frac{\cos^2 n}{3^n}$ is convergent or divergent.

n) Prove that the series $\sum \frac{(-1)^{n+1}}{n}$ is conditionally convergent.

o) Determine if the alternating series $\sum_{n=1}^{\infty} \frac{1}{[\ln (n+1]^n}$ is convergent or divergent.

PART - B

UNIT-I

2. a) Assuming the condition of integrability solve $(2x + y^2 + 2zx)dx + 2xydy + x^2dz = 0$. (6)

   b) Solve $p(1 + q) = qz$ (6)

   c) Solve $p^2 - y^3q = x^2 - y^2$ (6)

3. a) Solve $(3z - 4y)p + (4x - 2z)q = 2y - 3x$ (6)

   b) Solve $p^2 + q^2 = npq$ (6)

   c) Solve $p(1 + q^2) = q(z - a)$ (6)

UNIT-II

4. a) If $\{v_1, v_2, \ldots v_n\}$ is a basis of V and $\{w_1, w_2, \ldots w_m\}$ are linearly independent in V then prove that $m \leq n$. (6)

   b) If V is a vector space over F and W is a subspace of V then prove that

   $$dim\, V/W = dimV - dimW.$$ (6)

   c) If V is finite dimensional inner product space and W is a subspace of V when prove that V is the direct sum of W and $W^{\perp}$. (6)

5. a) V is a vector space over F. For any nonempty subset S of V define L(S), the linear span of S. Prove that L(S) is a subspace of V . (6)

   b) V is a vector space over F. Prove that the vectors $\{v_1\ v_2 \ldots\ldots v_n\}$ in V are linearly independent or some v_k is a linear combination of its proceeding ones. (6)

   c) If V is an inner product space over F, for any u, v ∈ V prove that $|(u, v)| \leq \|u\|\|v\|$. (6)

UNIT-III

6. a) Define the linear transformation of a vector space V into W. Prove that the product of two linear transformations of V into V is linear. (6)

   b) Prove that a linear transformation T of a vector space V with basis $\alpha_1,\ \alpha_2, \ldots\ldots\ \alpha_n$, is nonsingular if and only if the vectors $\alpha_1T,\ \alpha_2T, \ldots\ldots\ \alpha_nT$, are linearly independent in V. When this is the case, prove that T has a two sided inverse T^{-1} such that $TT^{-1} = T^{-1}T = I$. (6)

   c) Find the inverse of the matrix $\begin{pmatrix} 1 & 0 & 3 \\ 2 & 4 & 1 \\ 1 & 3 & 0 \end{pmatrix}$ using linear transformations. (6)

7. a) If $\{\beta_1, \beta_2 \ldots\ldots \beta_m\}$ is any basis of a vector space V and $\{\alpha_1, \alpha_2 \ldots\ldots \alpha_m\}$ are any m vectors in W. Prove that there is one and only one linear transformation of V into W such that $T(\beta_1) = \alpha_1, T(\beta_2) = \alpha_2\ \ldots\ldots T(\beta_m) = \alpha_m$ (6)

   b) If the linear transformation $T: V \to W$ is a one-one transformation of V onto W prove that T^{-1} is linear. (6)

   c) Find the inverse of the matrix $\begin{pmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix}$ using linear transformation. (6)

P.T.O.

UNIT-IV

8. a) Prove that a bounded monotonic sequence is convergent. (6)

   b) If the series $\sum_{n=1}^{\infty} u_n$ is convergent then prove that $\lim_{n\to\infty} u_n = 0$. Hence prove that the series $\sum_{n=1}^{\infty} \frac{n^2+1}{n^2}$ is divergent. (6)

   c) Prove that the series $\sum \frac{1}{n!}$ is convergent. (6)

9. a) Using the definition prove that the sequence $\frac{n}{2n+1}$ has the limit $\frac{1}{2}$. (6)

   b) Let the series $\sum_{n=1}^{\infty} u_n$ be a series of positive terms. If $\sum v_n$ is a series of positive terms that is known to be convergent and $u_n \leq v_n$ for all positive integers n. Then prove that $\sum_{n=1}^{\infty} u_n$ is convergent. (6)

   c) Prove that a convergent monotonic sequence is bounded. (6)

UNIT – V

10. a) Prove that the alternating series $\sum_{n=1}^{\infty}(-1)^{n+1} a_n$ where $a_n > 0$ is convergent if $a_{n+1} < a_n$ and $\lim_{n\to\infty} a_n = 0$. (6)

    b) Determine if the following series is convergent or divergent : $\sum_{n=1}^{\infty} \frac{4}{3^n+1}$ (6)

    c) Determine if the following series is convergent or divergent : $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n^2+4n}}$

11. a) Test for convergence of the series $\sum_{n=1}^{\infty}(-1)^{n+1} \frac{n}{2^n}$. (6)

    b) Test for convergence of the series $\sum_{n=1}^{\infty}(-1)^n \frac{3^{2n+1}}{n^{2n}}$ by root test. (6)

    c) Test for convergence of the series $\sum(-1)^n \frac{n!}{2^{n+1}}$ by ratio test. (6)

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18MAT622 Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MATHEMATICS

PAPER VIII: Numerical Methods

Duration: 3 hours **Max Marks: 120**

Note: 1. Answer any TEN questions from Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A 10×3=30

1. a) i) Round 0.0724472 correct to 4 significant figures.
ii) Is the equation $xe^x - tan^{-1}x = 0$ algebraic or transcendental?

b) If E_a and E_b are the errors in a and b respectively ,then find the error in a/b.

c) What are the advantages of Lagranges interpolation formula over Newtons formula?

d) Obtain a formula for divided difference $[x_0, x_1, x_2, x_3]$.

e) Write Simpson's $\frac{3}{8}^{th}$ rule to evaluate $\int_a^b f(x)dx$.

f) Find the approximate value of $\int_0^1 \frac{dx}{x+1}$ correct to 3 decimal places, using trapezoidal rule with h=0.5.

g) i) What must be the sign of $f(a).f(b)$ if a root of $f(x) = 0$ lies in $a \leq x \leq b$.

ii) Write the formula for finding the root using the method of false position.

h) Find the rank of the matrix $\begin{bmatrix} 2 & 1 & 3 \\ 3 & 5 & -2 \\ 4 & 0 & 1 \end{bmatrix}$

i) If $y' = x + y$, $y(0) = 0$ find $y(0.2)$ using Euler's method with $h = 0.2$.

j) Write Adam Bashforth predictor corrector formula.

k) i) When do we say that the system $AX = B$ is consistent?

ii) Which method is also known as the method of simultaneous displacements?

l) Test whether the matrix $\begin{bmatrix} cos\emptyset & sin\emptyset \\ sin\emptyset & -Cos\emptyset \end{bmatrix}$ is orthogonal.

m) Write n^{th}approximation in Picard's method to the solution of $\frac{dy}{dx} = f(x, y)$, $y(x_0) = y_0$.

n) i) Under what conditions does Gauss-Scidel method converge?

ii) Write Runge-Kutta second order formula.

o) Find the row norm of the matrix $\begin{bmatrix} 5 & -2 & 4 \\ -2 & 1 & 3 \\ 1 & 0 & -1 \end{bmatrix}$

PART - B

UNIT-I

2. a) Describe the method of bisection. **(6)**

   b) Using Newton-Raphson method obtain the real root correct to 3 decimal places of the equation, $x^3 - 2x - 5 = 0$,choose $x_0 = 2$. **(6)**

   c) Solve $x^3 - 2x - 5 = 0$, using False position method. **(6)**

3. a) Find a real root of the equation $2x = cosx + 3$ correct to 3 decimal places using Iteration method (choose $x_0 = \frac{\pi}{2}$) **(6)**

   b) Using the generalized Newton's formula find the double root of the equation $x^3 - x^2 - x + 1 = 0$ (Choose $x_0 = 0.8$) **(6)**

   c) Using the method of bisection, solve $x^3 - x - 1 = 0$ correct to 3 decimal places. **(6)**

UNIT-II

4. a) In the table below, the values of x and y are given.

x	3	4	5	6	7	8	9
y	2.7	6.4	12.5	21.6	34.3	51.2	72.9

   Find the tenth term of the series. **(6)**

   b) Derive Newton's forward interpolation formula to interpolate $f(x)$ on the set of points $(x_0, y_0), (x_1, y_1), \ldots, (x_n, y_n)$. **(6)**

   c) Find the cubic polynomial which takes values $y(0) = 1, y(1) = 0, y(2) = 1,$ $y(3) = 10$ **(6)**

5. a) Using Lagrange's interpolation formula resolve into partial fractions $\frac{3x^2+x+1}{(x-1)(x-2)(x-3)}$ **(6)**

   b) Find $\sqrt{155}$ from the following tabular values. **(6)**

x	150	152	154	156
$\sqrt{x}$	12.247	12.329	12.410	12.490

   c) Find the missing term in the following table. **(6)**

x	0	1	2	3	4
y	1	3	9	?	81

UNIT-III

6. a) Derive Simpson's $\frac{1}{3}^{rd}$ rule. **(6)**

   b) Given set of tabulated points $(1, -3), (3, 9), (4, 30)$and $(6, 132)$ obtain the value of y when $x = 2$ using Newton's divided difference formula. **(6)**

   c) The following table of values x & y are given, find $\frac{dy}{dx}$ when $x = 1$ **(6)**

x	0	1	2	3	4	5	6
y	6.9897	7.4036	7.7815	8.1291	8.4510	8.7506	9.0309

7. a) Derive trapezoidal rule to evaluate $\int_a^b f(x)dx$. **(6)**

b) Find $\frac{d^2y}{dx^2}$ at x = 2.2 for the following data.

x	1	1.2	1.4	1.6	1.8	2	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

(6)

c) Evaluate $\int_0^1 \frac{1}{1+x}dx$, $h = 0.125$ using Simpson's $1/3^{rd}$ Rule. **(6)**

UNIT-IV

8. a) Find whether the following system of equations is consistent or not.

$x - 4y + 5z = 8$
$3x + 7y - z = 3$
$x + 15y - 11z = -14$ **(6)**

b) Find the inverse of the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$ using Gauss – Elimination method. **(6)**

c) Solve by Jacobi method.

$10x + y + z = 15$
$x + 10y + z = 24$
$x + y + 10z = 33$ carry out 3 iterations. **(6)**

9. a) Express the matrix $\begin{bmatrix} 3 & 9 & 10 \\ 8 & 4 & 11 \\ 7 & 6 & 5 \end{bmatrix}$ as a sum of symmetric and skew – symmetric matrix. **(6)**

b) Solve the system of equations by Gauss elimination method.

$2x + 4y + z = 3$
$3x + 2y - 2z = -2$
$x - y + z = 6$ **(6)**

c) Using Gauss-Seidel method solve the system.

$10x_1 - 2x_2 - x_3 - x_4 = 3$
$-2x_1 + 10x_2 - x_3 - x_4 = 15$
$-x_1 - x_2 + 10x_3 - 2x_4 = 27$
$-x_1 - x_2 - 2x_3 + 10x_4 = -9$
Carry out 2 iterations. **(6)**

UNIT – V

10. a) Solve $y' = x - y^2$; $y(0)1$ and find $y(0,1)$ correct to 4 decimal points by Taylor Series method. **(6)**

b) Derive Adams – Moulton corrector formula to solve $\frac{dy}{dx} = f(x,y)$. **(6)**

c) Using modified Euler's formula estimate $y(0.1) if\ y' = x^2 + y,\ y(0) = 1$ take $h = 0.1$ **(6)**

P.T.O.

11. a) Given $y' = x + y^2$ with $y = 1$ when $x = 0$, solve by Picard's method. **(6)**

b) Using Predictor corrector formula , for $\frac{dy}{dx} = 1 + y^2$ with $h = 0.2$ compute $y = (0.8)$ Given $y(0) = 0, y(0.2) = 0.2027, y(0.4) = 0.4228 , y(0.6) = 0.6841.$ **(6)**

c) Using Runge – Kutta method of order 4, determine $y(0.1)$ and $y(0.2)$ for $\frac{dy}{dx} = y - x$, $y(0) = 2$ correct to 4 decimal places (take h=0.1) **(6)**

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18MAT632 Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MATHEMATICS

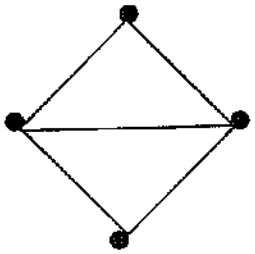
PAPER VIII: Graph Theory

Duration: 3 hours **Max Marks: 120**

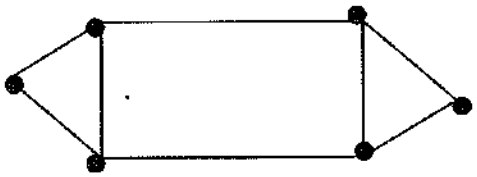
Note: 1. Answer any TEN questions from Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A 10×3=30

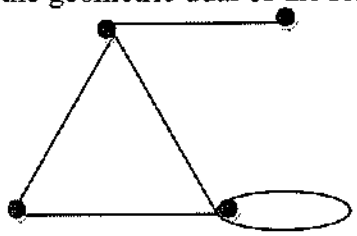
1. a) Show that the number of vertices of odd degree in a graph is always even.
b) Define i) Walk in a graph ii) Binary tree
c) Define spanning tree in a graph and write two spanning trees of the following graph.



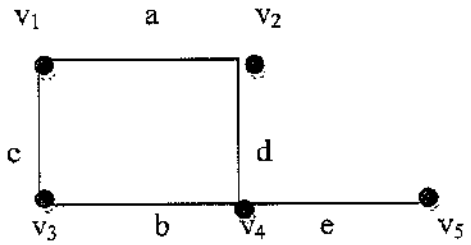
d) Show that the edge connectivity of any graph G cannot exceed the degree of the vertex with the smallest degree in G.
e) Write the edge connectivity and vertex connectivity of the following graph.



f) Draw the geometric dual of the following graph.

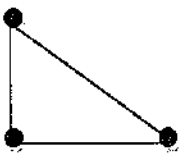


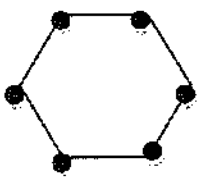
g) Show that the reduced incidence matrix of a tree is non-singular.
h) Write the incidence matrix of the following graph.



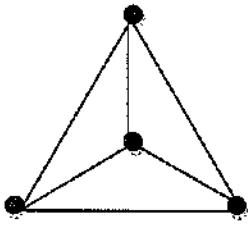
(6)

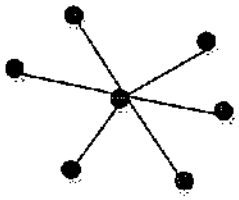
i) Prove that the set of circuit vectors in W_G forms a subspace of W_r.
j) Define: i) Proper colouring and ii) Chromatic number of graphs.
k) Write the chromatic number of the following graphs:

i) 

ii) 

l) Write the chromatic polynomial of the following graphs.

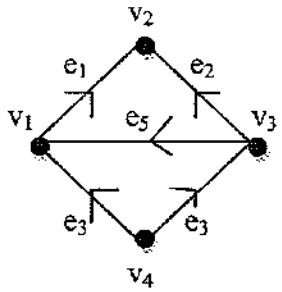
i) 

ii) 

m) Define: i) Arborescence ii) Regular digraph.

n) Define weakly connected and strongly connected digraphs.

o) Write the circuit matrix of the following digraph:

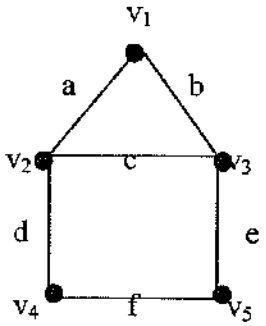


PART - B

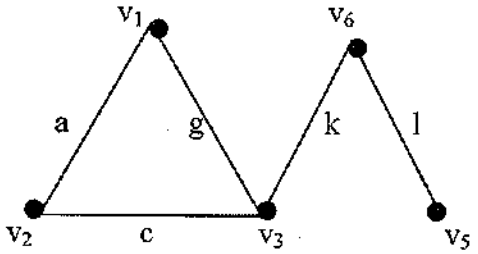
UNIT-I

2. a) Prove that a simple graph with n vertices and k components can have at most $\frac{(n-k)(n-k+1)}{2}$ edges. **(6)**

b) For the graphs G_1 and G_2 given below draw the following graphs.
1)$G_1 \cup G_2$ 2) $G_1 \cap G_2$ 3) $G_1 \oplus G_2$ **(6)**



G_1



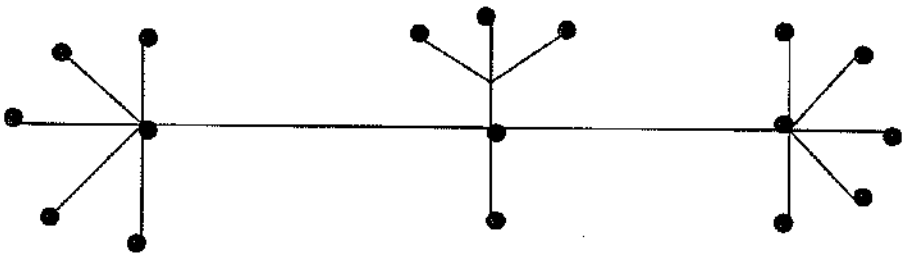
G_2

c) Prove that the number of vertices n in a binary tree is always odd. **(6)**

3. a) Show that a connected graph G is an Euler graph if and only if it can be decomposed into circuits. **(6)**

b) Prove that a tree with n vertices has n – 1 edges. **(6)**

c) Find the center or centers of the following tree. **(6)**



UNIT-II

4. a) Prove that with respect to a given spanning tree T, a branch b_i that determines a fundamental cutest S is contained in every fundamental circuit associated with the chords in S and in no other. **(6)**

   b) Prove that a graph can be embedded in the surface of a sphere if and only if it can be embedded in a plane. **(6)**

   c) Prove that a complete graph of five vertices, K_5 is non planar. **(6)**

5. a) Prove that every circuit has even number of edges in common with any cutset. **(6)**

   b) Prove that a regular graph of six vertices, $K_{3,3}$ is non planar. **(6)**

   c) Prove that a connected graph with n vertices and e edges has e – n + 2 regions. **(6)**

UNIT-III

6. a) If A (G) is the incidence matrix of a connected graph G with n vertices, show that rank of A(G) = n – 1. **(6)**

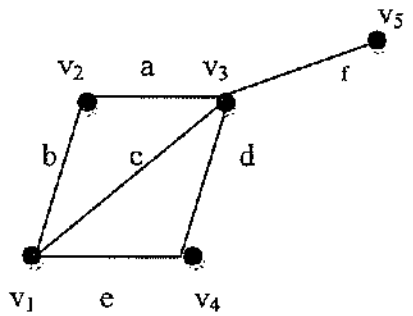
   b) Let B and A be respectively the circuit matrix and the incidence matrix of a self – loop free graph whose columns are arranged using the same order of edges. Then prove that every row of B is orthogonal to every row of A, that is $AB^T \equiv BA^T \equiv 0 \pmod 2$ where T denotes the transposed matrix. **(6)**

   c) In a vector space of a graph, prove that the circuit subspace and the cutset subspace are orthogonal to each other. **(6)**

7. a) Prove that the ring sum of two circuits in a graph G is a circuit or an edge disjoint union of circuits. **(6)**

   b) If B is a circuit matrix of a connected graph G with e edges and n vertices, prove that rank of B = e – n + 1 **(6)**

   c) Write the adjacency matrix of the following graph. **(6)**



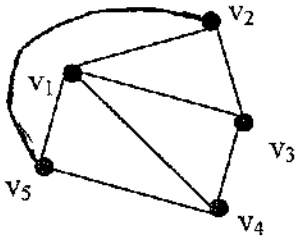
UNIT-IV

8. a) Prove that every tree with 2 or more vertices is two chromatic. **(6)**

   b) Prove that a graph with at least one edge is 2 chromatic if and only if it has no circuits of odd length. **(6)**

   c) Prove that a graph with n vertices is a tree if and only if its chromatic polynomial is $P_n(\lambda) = \lambda(\lambda - 1)^{n-1}$. **(6)**

9. a) Find the chromatic polynomial of the following graph. (6)

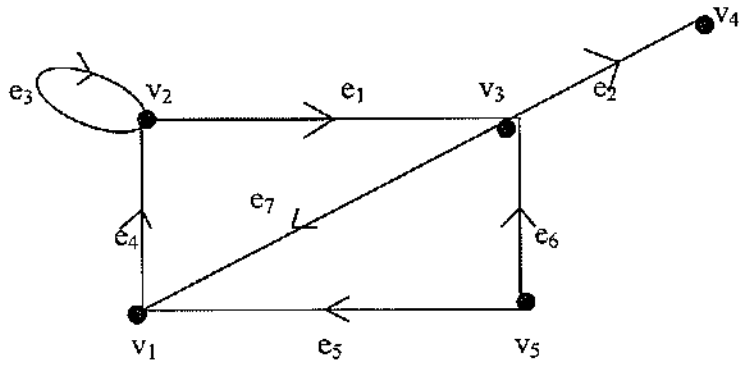


b) Prove that a graph with n vertices is a complete graph if and only if its chromatic polynomial is $P_n(\lambda) = \lambda(\lambda-1)(\lambda-2)\ldots(\lambda-n+1)$ (6)

c) Let a and b be two non-adjacent vertices in a graph G. Let G' be a graph obtained by adding an edge between a and b. Let G''be the simple graph obtained from G by fusing the vertices a and b together and replacing sets of parallel edges with a single edge. Prove that $P_n(\lambda)\ of\ G = P_n(\lambda)\ of\ G' + P_{n-1}(\lambda)\ of\ G''$. (6)

UNIT – V

10. a) Define incidence matrix of a digraph and write the incidence matrix of the following digraph. (6)



b) Prove that an arborescence is a tree in which every vertex other than the root has an in degree of exactly one. (6)

c) Let A_f be the reduced incidence matrix of a connected digraph. Then prove that the number of spanning trees in the graph equals the value of $\det(A_f, A_f^T)$. (6)

11. a) Let B and A respectively be the circuit matrix and the incidence matrix of a self-loop free digraph such that the columns of B and A re arranged using the same order of edges. Then prove that every row of B is orthogonal to every row of A. (6)

b) If A is the incidence matrix of a digraph, then prove that every square submatrix of A has determinant 1, -1, 0. (6)

c) Prove that a digraph G is an Euler digraph if and only if it is connected and balanced. (6)

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MAT602.3

Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MATHEMATICS

PAPER VIII: Graph Theory

Duration: 3 hours **Max Marks: 120**

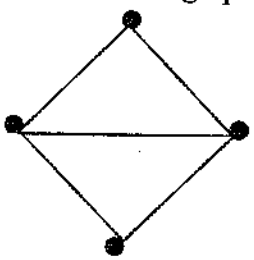
Note: 1. Answer any TEN questions from Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A

1. a) Show that the number of vertices of odd degree in a graph is always even. **10×3=30**

b) Define i) Walk in a graph ii) Binary tree

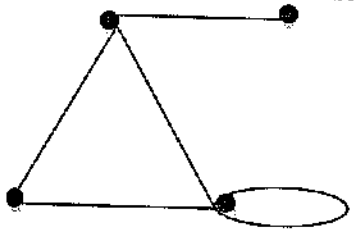
c) Define spanning tree in a graph and write two spanning trees of the following graph.



d) Show that the edge connectivity of any graph G cannot exceed the degree of the vertex with the smallest degree in G.

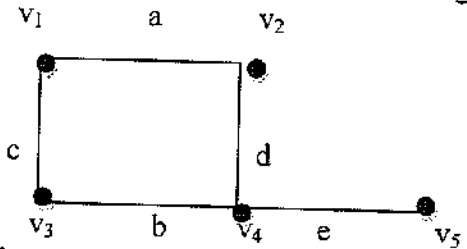
e) Write the edge connectivity and vertex connectivity of the following graph.

f) Draw the geometric dual of the following graph.



g) Show that the reduced incidence matrix of a tree is non-singular.

h) Write the incidence matrix of the following graph.

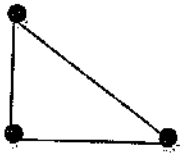


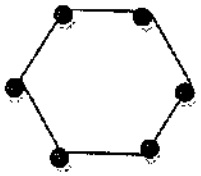
(6)

i) Prove that the set of circuit vectors in W_G forms a subspace of W_T

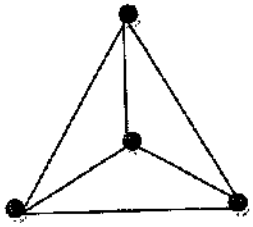
j) Define: i) Proper colouring and ii) Chromatic number of graphs.

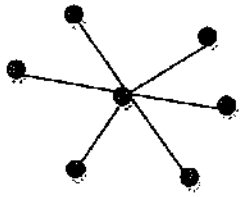
k) Write the chromatic number of the following graphs:

i) 

ii) 

l) Write the chromatic polynomial of the following graphs.

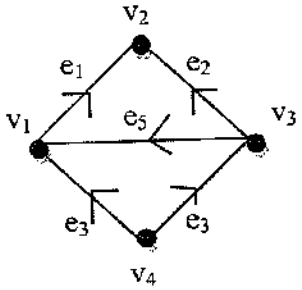
i) 

ii) 

m) Define: i) Arborescence ii) Regular digraph.

n) Define weakly connected and strongly connected digraphs.

o) Write the circuit matrix of the following digraph:

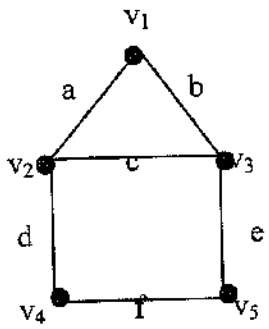


PART - B

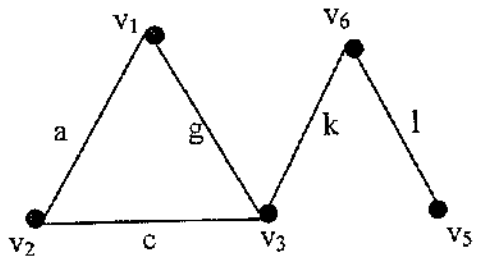
UNIT-I

2. a) Prove that a simple graph with n vertices and k components can have at most $\frac{(n-k)(n-k+1)}{2}$ edges. **(6)**

b) For the graphs G_1 and G_2 given below draw the following graphs. **(6)**
1) $G_1 \cup G_2$ 2) $G_1 \cap G_2$ 3) $G_1 \oplus G_2$



G_1



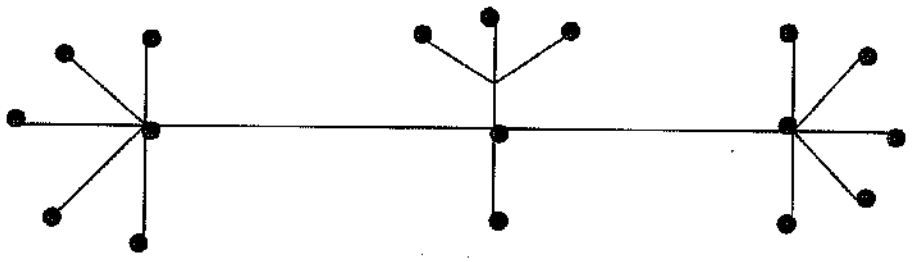
G_2

c) Prove that the number of vertices n in a binary tree is always odd. **(6)**

3. a) Show that a connected graph G is an Euler graph if and only if it can be decomposed into circuits. **(6)**

b) Prove that a tree with n vertices has n – 1 edges. **(6)**

c) Find the center or centers of the following tree. **(6)**



UNIT-II

4. a) Prove that with respect to a given spanning tree T, a branch b_i that determines a fundamental cutest S is contained in every fundamental circuit associated with the chords in S and in no other. **(6)**

   b) Prove that a graph can be embedded in the surface of a sphere if and only if it can be embedded in a plane. **(6)**

   c) Prove that a complete graph of five vertices, K_5 is non planar. **(6)**

5. a) Prove that every circuit has even number of edges in common with any cutset. **(6)**

   b) Prove that a regular graph of six vertices, $K_{3,3}$ is non planar. **(6)**

   c) Prove that a connected graph with n vertices and e edges has e – n + 2 regions. **(6)**

UNIT-III

6. a) If A (G) is the incidence matrix of a connected graph G with n vertices, show that rank of A(G) = n – 1. **(6)**

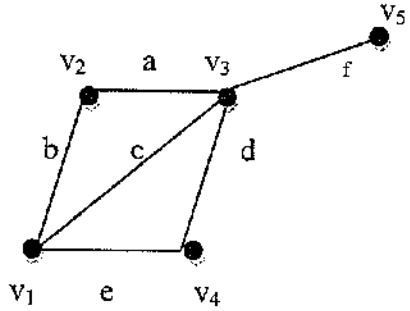
   b) Let B and A be respectively the circuit matrix and the incidence matrix of a self – loop free graph whose columns are arranged using the same order of edges. Then prove that every row of B is orthogonal to every row of A, that is $AB^T \equiv BA^T \equiv 0 \pmod 2$ where T denotes the transposed matrix. **(6)**

   c) In a vector space of a graph, prove that the circuit subspace and the cutset subspace are orthogonal to each other. **(6)**

7. a) Prove that the ring sum of two circuits in a graph G is a circuit or an edge disjoint union of circuits. **(6)**

   b) If B is a circuit matrix of a connected graph G with e edges and n vertices, prove that rank of B = e – n + 1 **(6)**

   c) Write the adjacency matrix of the following graph. **(6)**



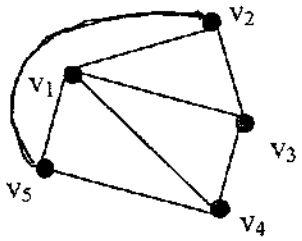
UNIT-IV

8. a) Prove that every tree with 2 or more vertices is two chromatic. **(6)**

   b) Prove that a graph with at least one edge is 2 chromatic if and only if it has no circuits of odd length. **(6)**

   c) Prove that a graph with n vertices is a tree if and only if its chromatic polynomial is $P_n(\lambda) = \lambda(\lambda - 1)^{n-1}$. **(6)**

9. a) Find the chromatic polynomial of the following graph. **(6)**

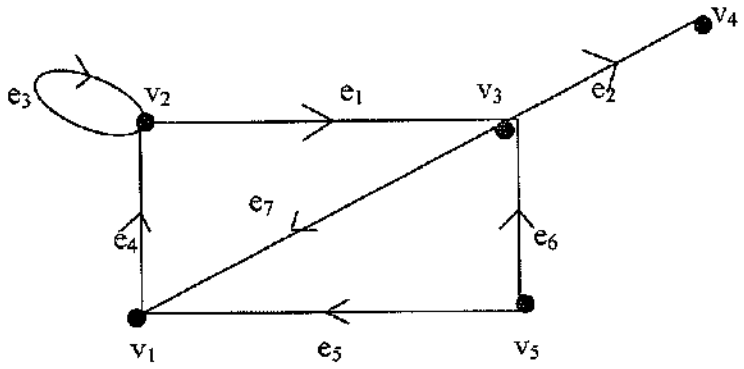


b) Prove that a graph with n vertices is a complete graph if and only if its chromatic polynomial is $P_n(\lambda) = \lambda(\lambda-1)(\lambda-2)\ldots(\lambda-n+1)$ **(6)**

c) Let a and b be two non-adjacent vertices in a graph G. Let G' be a graph obtained by adding an edge between a and b. Let G''be the simple graph obtained from G by fusing the vertices a and b together and replacing sets of parallel edges with a single edge. Prove that $P_n(\lambda)\ of\ G = P_n(\lambda)\ of\ G' + P_{n-1}(\lambda)\ of\ G''$. **(6)**

UNIT – V

10. a) Define incidence matrix of a digraph and write the incidence matrix of the following digraph. **(6)**



b) Prove that an arborescence is a tree in which every vertex other than the root has an in degree of exactly one. **(6)**

c) Let A_f be the reduced incidence matrix of a connected digraph. Then prove that the number of spanning trees in the graph equals the value of $\det(A_f, A_f^T)$. **(6)**

11. a) Let B and A respectively be the circuit matrix and the incidence matrix of a self-loop free digraph such that the columns of B and A re arranged using the same order of edges. Then prove that every row of B is orthogonal to every row of A. **(6)**

b) If A is the incidence matrix of a digraph, then prove that every square submatrix of A has determinant 1, -1, 0. **(6)**

c) Prove that a digraph G is an Euler digraph if and only if it is connected and balanced. **(6)**

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18MIC601

Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021
MICROBIOLOGY
Microbiology Theory VII

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. Write any two standards and criteria for food quality control.
2. What are Dill pickles?
3. Define gassy fermentation.
4. List the cocci in milk.
5. Define Primary Screening.
6. Write the Temperature, Time, Substrate and Organism needed for Penicillin Production.

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. Write a brief note on - Mycotoxins.
8. Write a note on blanching.
9. Explain Methylene Blue Reduction Test.
10. Explain the different methods of sterilization of milk.
11. Define fermentor and explain about product recovery using Vaccum drum dryer.
12. List the methods used for media sterilization and explain the factors affecting these methods.

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Describe the estimation of microbial content of food by total viable colony count.
14. Give a detailed account of the contamination of animal products.
15. Describe the factors responsible for the spoilage of food.
16. Explain in detail about Cheese and Yoghurt.
17. Explain the Wine Production in Industries.

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MIC 601.1 Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MICROBIOLOGY

PAPER VII-FOOD DAIRY AND INDUSTRIAL MICROBIOLOGY

Duration: 3 Hours **Max Marks: 80**

Note: Draw diagrams wherever necessary.

PART A

I. Answer any TEN of the following: **10x2=20**

a) Semiperishable Food
b) Pasteurization
c) Molasses
d) Endotoxins
e) Turbidity Test
f) Vaccum Drum Drier
g) Dehydration
h) Yoghurt
i) Saccharomyces Cerevisiae
j) Pickles
k) HTST
l) Streptomycin

PART-B

UNIT-I

Answer any TWO complete questions of the following: **2x10=20**

II. a) Discuss different food poisoning caused by Clostridium species. 06
b) Write a note on chemical preservatives used in food. 04

III. a) Explain the role of different temperatures in food preservation. 06
b) Write a note on contamination of Poultry. 04

IV. a) Discuss the factors responsible for spoilage of food. 06
b) Write a short note on criteria used for food quality control. 04

UNIT-II

Answer any TWO complete questions of the following: **2x10=20**

V. a) Discus the biochemical activities taking place in Milk. 06
b) Write a short note on Reductase Tests. 04

VI. a) Discuss the sources of Microbial contamination of Milk. 06
b) Write a short note on DMC. 04

VII. a) Discuss about the Microorganisms in Milk. 06
b) Write a short note on Cheese. 04

UNIT-III

Answer any TWO complete questions of the following: **2x10=20**

VIII. a) Discuss the steps involved in strain development for Fermentation. 06
b) List the characteristics of an ideal Fermentor. 04

IX. a) Discuss the methods of sterilization of Media. 06
b) Write a brief note on production of Alcohol. 04

X. a) Explain industrial production of Penicillin. 06
b) Write a note on preservation of stock cultures. 04

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MIC 602.5 Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

MICROBIOLOGY

Bacterial Genetics

Duration: 3 Hours **Max Marks: 80**

Note: Draw diagrams wherever necessary.

PART A

I. Answer any TEN of the following: **10x2=20**

a) Induced Mutation
b) Eco RI
c) Frame shift Mutation
d) DNA
e) Genetic engineering
f) Polymerases
g) Genetic code
h) Reverse Transcriptase
i) Gamma Rays
j) Transduction
k) Intergenic Mutation
l) Insulin

PART-B

UNIT-I

Answer any TWO complete questions of the following: **2x10=20**

II. a) Explain Translation in Prokaryotes. 06
b) Write a note on Gene expression and Regulation. 04

III. a) Explain the mRNA and rRNA. 06
b) Write a note on Griffith's experiment. 04

IV. a) With a neat illustration explain the Watson and crick model of DNA. 06
b) Write a note on structure of tRNA. 04

UNIT-II

Answer any TWO complete questions of the following: **2x10=20**

V. a) Explain the types of Macrolesions. 06
b) Write a note on Mutations rate and DNA repair. 04

VI. a) Explain the isolation of biochemical Mutants by replica plating technique. 06
b) Write a note on base pair substitution. 04

VII. a) Explain the types of mutation based on chemical agents. 06
b) Write a note on Mutation by UV rays. 04

UNIT-III

Answer any TWO complete questions of the following: **2x10=20**

VIII. a) Explain the Hybridisation technique for Isolation of DNA. 06
b) Write a note on Nif genes. 04

IX. a) Explain the cloning vectors used in genetic engineering. 06
b) Write a note on splicing and insertion of DNA. 04

X. a) Explain the potential hazards and safeguards of genetic engineering. 06
b) Write a note on Anti-Rabies Vaccine. 04

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18MIC612

Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021
MICROBIOLOGY
Microbiology Theory VIII

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. Define genetic code.
2. Define phosphodiester bond.
3. Write about mutation rate.
4. Define the term Mutation.
5. Define a super bug with an example.
6. What is Genetic Engineering?

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. Explain Griffith's experiment.
8. Write a brief note on Translation.
9. Describe the formation of plasmid chimera during the isolation of DNA.
10. Define auxotrophs and write about Replica Plating Technique.
11. Write a note on Restriction Enzymes.
12. Write any three salient features of plasmids and cosmids.

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Explain the structure and biological significance of mRNA and tRNA.
14. Explain in detail about the enzymes involved in replication of DNA.
15. Define mutation, mutants and write about DNA repair.
16. Differentiate between macrolesions and microlesions.
17. Describe the terminal transferase method of Splicing and Insertion of DNA.

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18PHY601 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

PHYSICS

Paper VII: Nuclear Physics

Duration:3 Hrs **Max Marks:80**

PART - A

Answer any TWELVE from the following: **(12×1= 12 Marks)**

1. What is the formula for the mass of a nucleus?
2. What are nuclear models?
3. What are magic numbers?
4. What is a breeder reactor?
5. What is the origin of stellar energy?
6. Give an example for artificially radioactive series.
7. What is radioactivity?
8. Give two biological effects of radiation.
9. What is artificial transmutation of elements?
10. What is a nuclear reaction cross section?
11. How does a cyclotron differ from a LINAC?
12. Write the expression for length of the cylinder in a linear accelerator.
13. What is the main application of silicon diode detector?
14. What are the hard and soft components of cosmic rays?
15. What is the nature of strong interactions?

PART - B

UNIT I

Answer any TWO from the following: **(2×8= 16 Marks)**

16. a) What are isotopes? Give example.

    b) Explain in detail nuclear angular momentum and nuclear magnetic moment. Hence arrive at an expression for the ratio of Nuclear magneton to Bohr magneton. (2+6)

17. a) Why stable nuclei have more neutrons than protons?

    b) Compare the liquid drop model with the shell model. Draw the graph representing binding energy per nucleon to its energy. (2+6)

18. a) Distinguish between nuclear fusion and nuclear fission.

    b) Deduce the four factor formula for a nuclear reactor. (2+6)

UNIT II

Answer any TWO from the following: **(2×8= 16 Marks)**

19. a) State the group displacement law in radioactivity.

    b) What are the three types of Beta decay. Explain with examples. (2+6)

20. a) State and explain Geiger Nuttal law.

    b) Write in detail about film badges and pocket dosimeter. (2+6)

21. a) Give one example each for (p,α) and (p,d) reactions.

    b) What is Q value and threshold energy of a nuclear reaction? Give its significance. (2+6)

UNIT III

Answer any TWO from the following: **(2×8= 16 Marks)**

22. a) Derive the resonance condition of a cyclotron.

    b) Deduce the expression for the energy of the particle and length of cylinder in terms of the constants of the linear accelerator. (2+6)

23. a) What are the applications and drawbacks of a GM counter?

    b) What are nuclear detectors? Describe with diagram the construction and working of a GM counter. (2+6)

24. a) Briefly explain annihilation of matter.

    b) Give an insight of the quark model and describe the formation of proton and neutron. (2+6)

PART - C

Answer any FOUR from the following: **(4×5= 20 Marks)**

25. Calculate the mass number of a nucleus whose radius is 3.16×10^{-15}m ($R_0 = 1.3 \times 10^{-15}$m).

26. The masses of the hydrogen atom and neutron are 1.008142 amu and 1.008982 amu respectively. Calculate the packing fraction and binding energy per nucleon of $_8O^{16}$ nucleus.

27. How much time will it take for a 8 mCi source to be reduced to 1 mCi source? Half life of the source is 10 years.

28. If Radon 222 emits alpha particle of energy 14.98 MeV, find alpha disintegration energy.

29. In a linear accelerator a proton accelerated thrice by a potential difference of 30,000 V leaves a tube and enters an accelerating space of length 0.45 m before entering the next tube. Calculate the frequency of RF voltage.

30. A betatron working on an operating frequency of 60 Hz has a stable orbit of radius 1.6 m. Find the final energy and energy gained per revolution by the electron, given magnetic flux density at the orbit = 0.5 T. Velocity of electrons is nearly equal to the velocity of light.

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PHY601.1 Reg. No.....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION
AUGUST 2021
PHYSICS
Paper VII: Electronics

Duration: 3 Hrs. Max. Marks: 80

PART – A

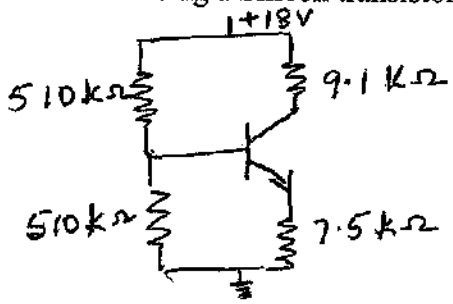
1. a) **Answer any TEN of the following:** **10×1=10**
   a) What is meant by rectification?
   b) Mention any difference between JFET and MOSFET.
   c) What is a voltage regulator?
   d) Why is base of a transistor made thin?
   e) What is meant by ac equivalent circuit?
   f) Define unity gain frequency for an OPAMP.
   g) Does the amplifier go into oscillations if feedback gain is ∞ ?
   h) Which configuration of transistor amplifier is used to connect a high impedance source to low impedance load?
   i) What is negative logic?
   j) When does toggling take place in a flip-flop?
   k) Define the depth of modulation of AM wave.
   l) If $X = A.B$, and $A = 1, B = 0$, find X.

   b) **Answer any FIVE of the following:** **5×2=10**
   i) Define α_{dc}, β_{dc} of a transistor and obtain the relation between them.
   ii) What is a rectifier and why junction diode is used as a rectifier?
   iii) Draw the frequency response of an amplifier in CE mode.
   iv) What is Slew rate and what is its significance?
   v) Explain how OR gate is obtained using NAND gates. Give the truth table of the gate obtained.
   vi) Give the block diagram of AM receiver.

PART – B
UNIT – I

Answer any TWO of the following: **2×10=20**

2. a) What is the dc load line and how is it obtained? Explain how Q – point is located?
   b) For the network given below using a Silicon transistor, find I_B, I_C, V_C, V_E, V_{CE}. $\beta = 130$.



[6 + 4]

3. a) Explain the working of an n-channel J-FET and draw the necessary structural diagram.
   b) With a given transistor $I_B = 25\mu A$, $I_C = 1.25mA$,
   Determine α, β and I_E. **[6 + 4]**

4. a) With a neat diagram explain the working of a bridge rectifier. And draw the necessary input and output waveforms.
   b) In a Zener shunt regulator circuit the input voltage is 9V and $V_Z = 6V$. If the maximum Zener current is 20mA, determine the value of series resistance R_S. If a load of 1kΩ is connected across the Zener diode, calculate load current and Zener current. **[6 + 4]**

UNIT – II

Answer any TWO of the following: **2×10=20**

5. a) Draw and explain ac equivalent circuits of a CE amplifier using r_e model and derive the operating characteristics.
   b) In a CE – mode, a silicon transistor circuit with voltage divider bias R_1=15kΩ, R_2=5kΩ, R_C=2kΩ, $R_E = R_L$ = 3kΩ, V_{CC}=20V, V_{BE} = 0.7V is used. Draw dc load line and locate Q-point. And also draw the ac load line. **[6 + 4]**

6. a) What is a non-inverting amplifier? Explain the same using OPAMP and derive expressions for voltage gain and input and output resistances.
   b) The differential gain of an OPAMP is 10^5. When common mode input voltage of 1mV is applied the output equals to 12mV. Calculate CMRR and express it in dB. **[6 + 4]**

7. a) With a neat circuit diagram, explain the working of a Wein Bridge Oscillator.
   b) An amplifier without feedback has an output of 25V for an input of 0.05V. If 1% negative feed back is applied, what is the output voltage? **[6 + 4]**

UNIT – III

Answer any TWO of the following: **2×10=20**

8. a) What is an adder? Explain the working of a half adder using necessary truth table. Give logic symbol.
   b) Simplify the truth table by sum of products method.

A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

[6 + 4]

9. a) Explain working of a binary counter using JK Flip-Flop and write the timing diagram.
   b) Simplify the Boolean expression and draw logic diagram.
   i) $Y = ABC + A\bar{B}C + A\bar{B}\bar{C}$ ii) $Y = AB\bar{C} + A\bar{B}\bar{C} + A\bar{B}C + \bar{A}BC$ **[6 + 4]**

10. a) Draw the cross sectional views of a CRT and mention briefly the functions of the various components.
   b) An AM wave is represented by the expression $V = 5(1 + 0.6\,cos6280t)\sin 211 \times 10^4 t$. What frequency components are contained in the modulated wave and what is the amplitude of each component? **[6 + 4]**

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18PHY612 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021
PHYSICS
Paper VIII: Electronics

Duration:3 Hrs **Max Marks:80**

PART - A

Answer any TWELVE from the following: **(12×1= 12 Marks)**

1. What is dc load line of a transistor?
2. Give the symbol of a MOSFET and what is the significance of arrow in it?
3. What are the two regions of a transistor?
4. Why is the current gain of CB configuration less than 1?
5. Define voltage regulation as applied to rectifiers.
6. Why is it desirable to have the operating point in the middle of load line in amplifiers?
7. Which configuration of a transistor amplifier is used to connect a high impedance source to a low impedance load?
8. What is the voltage gain of ideal operational amplifier?
9. What is an operational amplifier?
10. Write any two advantages of Wein-bridge oscillator.
11. How NOT gate is obtained using NAND gates?
12. What is a serial shift register?
13. What is a half adder?
14. What is communication?
15. What is vertical amplifier in a CRO?

PART - B
UNIT I

Answer any TWO from the following: **(2×8= 16 Marks)**

16. a) Mention any four advantages of JFET over BJT.

    b) Draw the output characteristics of a transistor in CE mode and explain the significance of different regions. (2+6)

17. a) How can one check whether a transistor is in working order or not?

    b) Draw and explain the drain characteristics and transfer characteristics of a JFET. (2+6)

18. a) Draw the circuit diagram of bridge rectifier with input and output waveforms.

    b) With a neat diagram explain how a Zener diode can be used as a voltage regulator. (2+6)

UNIT II

Answer any TWO from the following: **(2×8= 16 Marks)**

19. a) Give any two comparisons between CB and CC amplifiers.

    b) Draw and explain ac equivalent circuits of CE amplifier using r_e transistor model and derive the operating characteristics. (2+6)

20. a) Draw and explain the pin diagram of IC 741 OPAMP.

    b) What is a non-inverting amplifier? How can an OPAMP be used as a non-inverting amplifier? Derive expression for its voltage gain and mention the values of input & output resistances. (2+6)

21. a) Explain the Barkhausen criterion for oscillations.

    b) What is meant by feedback in amplifiers? Why it is needed? Derive an expression for the gain in a feedback amplifier in terms of feedback fraction. (2+6)

UNIT III

Answer any TWO from the following: **(2×8= 16 Marks)**

22. a) Write a short note on decimal number system.

    b) With diagram explain the working of an AND gate. Give its truth table, logic expression and logic symbol. (2+6)

23. a) Draw wave forms to show the formation of FM wave by the carrier wave and modulating signal.

    b) Describe AM radio receiver with a block diagram. (2+6)

24. a) What is progressive scanning and interlaced scanning?

    b) Describe FM radio transmitter with a block diagram. (2+6)

PART - C

Answer any FOUR from the following: **(4×5= 20 Marks)**

25. Transistor with voltage divider bias uses the following components $R_1 = 47k\Omega$, $R_2 = 12k\Omega$, $R_E = 500\Omega$, $R_C = 1k\Omega$, $V_{BE} = 0.6V$, $V_{CC} = 12V$. Determine the operating point.

26. Calculate the output dc voltage and efficiency for the bridge rectifier. Given $R_L = 100\ \Omega$, $r_f = 100\ \Omega$, $V_0 = 300\ V$

27. A transistor amplifier uses $R_1 = 56k\Omega$, $R_2 = 15k\Omega$, $R_C = 1k\Omega$, $R_E = 2k\Omega$, $V_{CC} = 20V$, $V_{BE} = 0.9V$, $R_L = 2k\Omega$. Draw the dc and ac load lines and mark the operating point.

28. For the circuit of inverting amplifier $r_f = 10\ k\Omega$, $R_1 = 10\ k\Omega$, Vin = - 0.5V Calculate (i) input current (ii) voltage across r_f and (iii) output voltage.

29. *Simplify the Boolean expression and draw the logic diagram for* $Y = AB + A\bar{C} + A\bar{B}C(AB + C)$

30. Calculate the modulation factor of an AM wave if the maximum peak to peak voltage is 16 mV and the minimum peak to peak voltage is 4 mV. Using this value, determine the total power of the AM wave. Power of the carrier wave is 5 KW.

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PHY602.3 Reg. No.....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION
AUGUST 2021
PHYSICS
Paper VIII: Nuclear Physics

Duration: 3 Hrs. **Max. Marks: 80**

PART – A

1. a) Answer any TEN of the following: **10×1=10**

a) What is tunnel effect in alpha decay?
b) What is a neutrino?
c) What is a transuranic element?
d) Write the unit of cross section for nuclear reaction.
e) What are isotones?
f) What is meant by nuclear quadrupole moment?
g) Define effective multiplication factor.
h) Mention one empirical fact to support the stability of nuclei containing magic numbers.
i) Give the betatron condition.
j) What is the principle of a semiconductor detector?
k) What are hardrons?
l) What are Van Allen Belts?

b) Answer any FIVE of the following: **5×2=10**

i) State the group displacement low in radio activity.
ii) Mention any two interactions of gamma rays with matter.
iii) Give any two similarities between a nucleus and a liquid drop.
iv) Write any two characteristics of nuclear forces.
v) Write any two differences between a cyclotron and a betatron.
vi) What is a cosmic ray shower? Explain.

PART – B
UNIT – I

Answer any TWO of the following: **2×10=20**

2. a) Explain Yukawa's meson field theory.
b) Find the values of nuclear density and nuclear magneton. Given: $R_0 = 1.2\ fm$ $h = 6.625 \times 10^{-34}\ Js$ mass of the $proton = 1.67 \times 10^{-27} kg$. **[6 + 4]**

3. a) Deduce semi empirical formula for nuclear mass.
b) A nuclear reactor is developing nuclear energy at the rate $3 \times 10^4 kW$. Find the mass of $^{235}_{92}U$ required for 1000 hours of operation, assuming that 200 MeV of energy is released per fission. The efficiency of the nuclear reactor is 20%. **[6 + 4]**

4. a) Write in detail a note on the properties and classification of neutrons.
b) A nuclear reactor has a power of 2000 MW. Find the mass of deuterium required per day using the fusion reaction. $^2_1H + ^2_1H \rightarrow ^4_2He$. **[6 + 4]**

UNIT – II

Answer any TWO of the following: **2×10=20**

5. a) What is radio carbon dating? Explain it to find the age of fossils.
   b) If the range of 5 MeV alpha particles is $3.55 \times 10^{-2} m$, find the range of alpha particles of velocity $2 \times 10^{7} ms^{-1}$. **[6 + 4]**

6. a) Derive an expression for alpha disintegration energy.
   b) Half life of Radon – 222 is 3.8 days and that of Radium – 226 is 1600 years. Calculate the mass of Radon that will be in equilibrium with 1 gram of Radium. **[6 + 4]**

7. a) What is artificial transmutation of elements? Explain Rutherford's experiment on first artificial transmutation.
   b) Calculate the threshold energy required to initiate the reaction ${}^{14}_{7}N(n,\alpha){}^{11}_{5}B$. Given masses of ${}^{14}_{7}N$, ${}^{1}_{0}n$, alpha particle and ${}^{11}_{5}B$ are 14.003074 amu, 1.00867 amu, 4.002603 amu 11.009305 amu respectively. **[6 + 4]**

UNIT – III

Answer any TWO of the following: **2×10=20**

8. a) Derive the condition for acceleration in a linear accelerator and obtain an expression for the final energy of the particles ejected from the accelerator.
   b) The radius of the dees of a cyclotron is 0.16m. The applied magnetic field is 1.5T. Calculate the frequency of revolution and the energy of the emerging protons. Given mass of a $proton = 1.672 \times 10^{-27} kg$. **[6 + 4]**

9. a) Describe the working of a GM counter with a neat diagram.
   b) A betatron working on an operating frequency 40 Hz has a stable orbit of radius 1.6 m. Find the final energy of the electrons and energy gained per revolution if magnetic field at the orbit is 0.5T. Assume that the velocity of the electrons is nearly equal to the velocity of light. **[6 + 4]**

10. a) Explain the variation of cosmic ray intensity with latitude and attitude.
    b) Find the final kinetic energy of protons in a linear accelerator having 100 gaps with a potential difference of 1KV across each gap. How rapidly the field between the drift tubes must be reversed if the frequency of the oscillator is 10 MHz. Given initial kinetic energy of the protons is 1 keV. **[6 + 4]**

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18STA601 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021
STATISTICS
Statistics Theory VII

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. Compare ANOVA with t test.
2. What are the least square estimates of the parameters μ ,α_i and β_j in the model of Two way ANOVA?
3. How do you estimate an efficiency of the design?
4. Give expressions for estimating two missing observations in case of RBD.
5. Distinguish between 2^2 and 2^3 factorial experiments.
6. What do you mean by complete confounding in factorial experiment?

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. Derive expected sum of squares of due to factor B under Two way Classified Data.
8. Obtain expected sum of squares due to factor A under Three way Classified Data.
9. Derive an expression for expected value of sum of squares due to Errors in case of RBD.
10. Illustrate an application of CRD with model and statistical analysis.
11. Describe Yate's method of computing factorial effects totals in a 2^3 factorial experiment.
12. Briefly explain confounded factorial designs. What is the need for confounding?

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Derive the Expected sum of squares due to a factor A and Error in One way Classified data.
14. Illustrate the technique of ANOVA for Three-way classification, stating the breakdown of the total sum of squares, their distributions and the hypothesis that are usually tested. Also write down the ANOVA Table.
15. Derive expressions for estimating two missing observation in case of L.S.D and give the ANOVA Table .
16. Latin Square Design is more efficient than Randomized Block Design. Justify.
17. What is Partial Confounding?Explain how the statistical Analysis can be carried out in case of Partial confounding.

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18STA622 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

STATISTICS

Statistics Theory VIII

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. What is Statistical Quality Control?
2. Define process control.
3. The average number of defects is found to be 1.59, find the control limits for number of defects chart.
4. Write the control limits of σ chart when the standards are unknown.
5. Find out reliability of the system with four components connected in parallel having reliabilities 0.96, 0.93, 0.92 and 0.88 respectively.
6. Define Sampling Inspection.

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. Explain the concept of rational subgroups.
8. What are assignable causes of variation?
9. Explain the concept of Single Sampling Plan by variables.
10. How is the choice between p and np charts made? Explain the different methods employed to deal with the problem of varying sample size in p-chart.
11. How do you construct SSP for attributes when two points on OC curve are given?
12. Stating the theoretical basis, derive control limits for u-chart when the standard value is known.

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Derive the control limits of $\bar{x}$ and R chart when the standards are known and unknown.
14. What are the criteria for lack of control with respect to control charts for variables ?
15. Stating the assumptions, derive the control limits of p chart when the sample size is constant.
16. Derive the expressions for the OC function for SSP by attributes when (i) Hyper Geometric distribution (ii) Binomial distribution (iii) Poisson distribution are used.
17. Define Mean time to failure and obtain its expression.Also list out the difference between MTTF and MTBF.

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18ZOO601 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

ZOOLOGY

Zoology Theory VII

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. What is the relationship between nature and nurture?
2. Write the principles of blood transfusion in humans.
3. What is haemophelia? What are its characteristics?
4. Name different test systems for Mutagens.
5. What is organic evolution?
6. Define the term Homology.

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. Explain the law of independent assortment with a suitable example.
8. Define Rh factor. Explain properties of Rh blood factor in humans.
9. What is eugenics? Explain positive and negative eugenics.
10. Write short note on the effects of hormone on sex determination with an example.
11. Write explanatory notes on a) Gene pool b) Gene frequency
12. Write explanatory notes on Equs.

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Explain polygenic inheritance with reference to eye colour in humans.
14. What are complementary factors? Explain with reference to flower color in sweet peas.
15. Give an account of the gene concept.
16. Elaborate on the various aspects of Genetic counselling.
17. Explain macro evolution with an example.

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18ZOO612 Reg No : .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021
ZOOLOGY
Zoology Theory VIII

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. Define mutualism with two examples.
2. What is phototaxis. Give an example.
3. Differentiate between vertical and horizontal stratification.
4. Define Limiting factors with an example.
5. What is Chi-Square test?
6. What is Minamata disease? Name the causative agent.

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. Explain biotic components of pond ecosystem.
8. With reference to soil as an abiotic factor explain soil organisms with examples.
9. With reference to landscape ecology, explain landscape patches and corridors.
10. Explain the flow of carbon into the biotic phase in the carbon cycle.
11. Enumerate six effects of soil pollution.
12. Discuss the sources and toxicity of radioactive compounds.

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Explain the subdivisions of ecology. Add a note on scope of ecology.
14. Give an account of characteristics of marine habitat.
15. With reference to population, explain Natality, Mortality and Biotic potential.
16. Give an account of endangered animals and the measures taken for their protection.
17. What is acid rain? Explain the causes and effects of acid rain.

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ZOO 602.4 Reg. No. .....

CREDIT BASED SIXTH SEMESTER B.Sc. DEGREE EXAMINATION AUGUST 2021

ZOOLOGY

ENVIRONMENT BIOLOGY, BIOSTATISICS AND TOXICOLOGY

Duration: 3 hours **Max marks: 80**

Note: Answer any TEN questions from Part-A
Answer SIX questions from Part-B choosing any two questions from each unit.

PART A

I. Answer any TEN of the following: **10x2=20**

1. Name any 4 branches of Ecology.
2. What is microfauna? Give 2 examples.
3. What is parasitism? Give an example for enoparasite.
4. Classify planktons based on life span.
5. Define ecological niches with an example.
6. What are limiting factors? Name any two.
7. What is Sedimentary cycle? Give an example.
8. Name any two methods of Ex-situ conservation of wildlife.
9. Define standard error. How is standard error of mean calculated?
10. Give one example each for neurotoxins and cytotoxins.
11. What is eutrophication?
12. Define photochemical smog.

PART-B

UNIT-I

II. a) Define abiotic factors. Explain temperature as abiotic factors with reference to thermal stratification, extreme temperatures and cycolomorphosis. 07

b) What is mutualism? Give any two examples. 03

III. a) Define estuary. Give the characteristics of estuary with reference to salinity turbulence and silt. Add a note on the fauna of estuaries. 07

b) Write a note on ecological spectrum. 03

IV. a) Comment on the biotic components of pond ecosystem. 05

b) What is Eltonian pyramids? Explain the pyramids of number and biomass. 05

UNIT-II

V. a) Define ecological succession. Explain kinds of succession, process of succession and theories of succession. 07

b) With reference to landscape ecology explain landscape matrix. 03

VI. a) What is a biogeochemical cycle? Explain Nitrogen cycle with schematic representation. 07

b) Explain Allee's principle. 03

VII. a) What are Endanger species? Write a note on endangered species of India. 05

b) Explain briefly the age distribution with reference to population ecology. 05

UNIT-III

VIII. a) Give an account of different methods of data representation. 07

b) Write a short note on detoxification. 03

IX. a) Discuss the nature of pollutants in water and suggest methods of control. 07

b) Calculate mean and median for the given ungrouped data. 03

12, 18, 40, 16, 4, 23, 37

X. a) What are pesticides? Discuss the effect of DDT. 05

b) Discuss the impact of global warming. 05

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