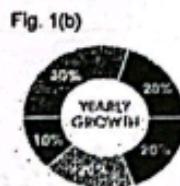
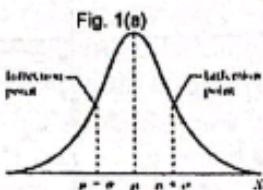


**Section-A**

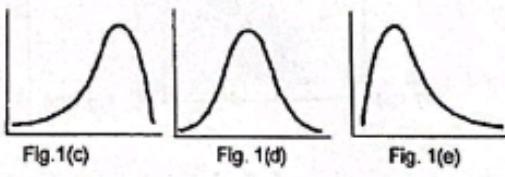
- 1(a) Which of the given figure does present a descriptive statistics or an inferential statistics? Explain your answer.



3

- 1(b) The Chairman of the Dept. of Computer Science and Engineering wants to compare the academic performance between the students of session 2019 and 2020. He has the CGPA of all students and he wishes to get this comparison done by you since you have studied a course of Stat-1211. Explain the statistical approaches you may follow for this task. Mention pros and cons of those approaches if any.

- 1(c) The probability distribution is shown by the given figures. What will be approximate position of mode, median and mean? Explain your answer.

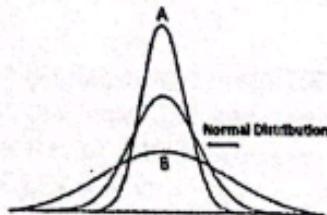


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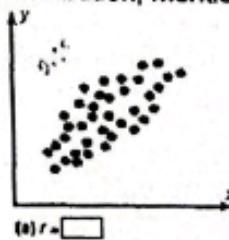
- 2(a) What is central tendency? Write down the measure of central tendency. 2.75
- (b) For non-zero positive observations show that  $AM \geq GM \geq HM$  (Notations are usual). 3
- (c) How can we measure the symmetry and asymmetry of a data distribution? Explain. 3
- 3(a) A box contains two Red balls. Another box of identical appearance contains one Red and one White ball. If a box is selected by chance and one ball is drawn from it, what is the probability that the first box was the selected one, if the drawn ball turns out to be Red? 4
- (b) A bag contains two white and four black balls. Two balls are drawn. In  $f(x, y)$ , let  $x$  and  $y$  represent the results of the two drawings; 0 corresponding to a black ball, 1 corresponding to a white ball. Find,  $f(0,1)$ ,  $f(0,0)$ ,  $f(1,0)$ ,  $f(1,1)$ , then from these four values, find  $f(0)$  and  $f(1)$ . 4.75

**Section-B**

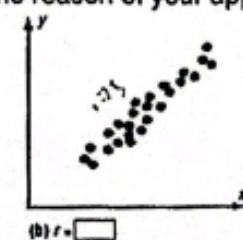
- 4(a)  $X$  denotes (i) the chance of exact amount rain tomorrow, (ii) sum of the points obtained in rolling two dices, which one is discrete and which one is continuous random variable? And why? 2
- (b) For the distribution given in the figure, between A and B, which one is platykurtic and which one is leptokurtic? Explain your answer. 2



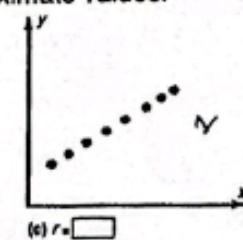
- (c) Interpret the distribution given below. Assign an approximate value of Correlation Coefficient for 3 each of following distribution, mention the reason of your approximate values.



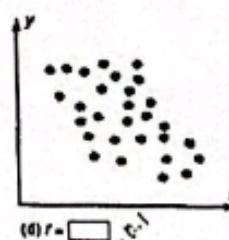
(a)  $r = \boxed{\phantom{00}}$



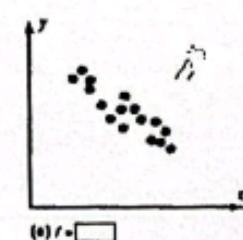
(b)  $r = \boxed{\phantom{00}}$



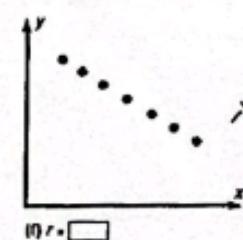
(c)  $r = \boxed{\phantom{00}}$



(d)  $r = \boxed{\phantom{00}}$



(e)  $r = \boxed{\phantom{00}}$



(f)  $r = \boxed{\phantom{00}}$

- (d) Which of the given figures, does not comply Pearson Correlation and why?



Fig. 4(a)



Fig. 4(b)

1.75

- 5(a) Mention, which of the given distribution complies with the assumption of Poisson distributions or not. Explain your answer.

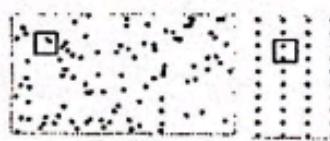


Fig. 5(a)

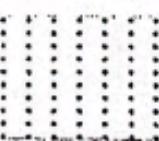


Fig. 5(b)

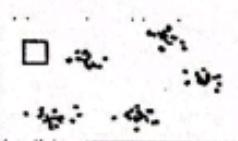


Fig. 5(c)

3

- (b) A survey from Teenage Research Unlimited (Northbrook, Illinois) found that 30% of teenage consumers receive their spending money from part-time jobs. If 5 teenagers are selected at random, find the probability that at least 3 of them will have part-time jobs.

3.75

- (c) The both two curves in each figure present the Normal distribution. But what is the difference between two curves in each figure?

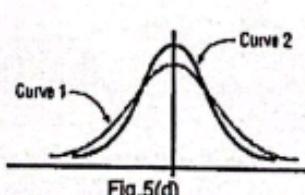


Fig. 5(d)

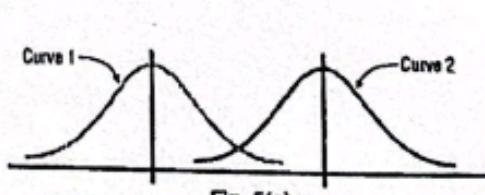


Fig. 5(e)

2

- 6(a) Define null hypothesis and alternative hypothesis.

2.75

- (b) Describe the test procedure for comparing two means.

3

- (c) How can you test differences of variances of two populations? Is it possible to test variances using t-test? Which statistical test is applicable for test of independence?

3

**Section-A**

- 1.a) What is variable? Define with example different types of variable. 3
- b) What do you mean by dispersion? Discuss different measures of dispersion 2%
- c) Calculate the standard deviation from the following data 3  
 40, 60, 65, 65, 65, 68, 68, 70, 70, 70, 70, 70, 74, 75, 75, 90, 95.
- 2.a) Define outcome, sample space and event of an experiment. 3
- b) State the law of total probability. 2
- c) What is conditional probability? If  $P(A) = 0.4$ ,  $P(B) = 0.5$  and  $P(A \cap B) = 0.3$ , then find  $P(A|B)$  and  $P(B|A)$ . 3%
- 3.a) What do you mean by random variable? 2
- b) Write down the probability density function of a normal distribution. What are the properties of standard normal distribution? 3%
- c) Given that  $X$  is a random variable whose mean = 3, find the variance of  $4X + 2$ . 3

**Section-B**

- 4.a) Define correlation coefficient, partial correlation coefficient and multiple correlation coefficient. 3
- b) How do you interpret the range of correlation coefficient? 2%
- c) Find the value of the correlation coefficient from the following table: 3

<i>Age (X)</i>	43	21	25	42	57	59
<i>Glucose Level (Y)</i>	99	65	79	75	87	81

- 5.a) Explain the simple linear regression model. 2%
- b) Discuss the principles of least-square method. 3
- c) Fit the regression equation from the following data with  $x$  as the independent variable. 3

<i>X (aptitude test)</i>	95	85	80	70	60
<i>Y (Statistics grade)</i>	85	95	70	65	70

- 6.a) Write down the goal and different steps of hypothesis testing. 2
- b) Describe the test procedure for comparing two means. 4
- c) The average daily intakes of dairy products for men (sample size=50, sample mean=756 and sample standard deviation=35) and women (sample size=50, sample mean=762 and sample standard deviation=30). Is there a difference in the average daily intakes of dairy products for men versus women? (At 5% level of significance, the critical region is  $z > 1.96$  or  $z < -1.96$ ) 2%

Time: 2 Hours

Answer any four questions taking two from each Section  
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**SECTION: A**

- 1 (a) What is central tendency? Write down the measures of central tendency. 2.75  
 (b) For non-zero positive observations show that  $AM \geq GM \geq HM$  (Notations are usual). 3  
 (c) The daily profit of 100 shops in a market are distributed as follow:

Profits (in lac Tk)	50-60	60-70	70-80	80-90	90-100
No. of Shops	18	32	24	16	10

Calculate mean, median and mode.

- 2 (a) Define coefficient of variance (c.v). Why do you prefer coefficient of variation instead of standard deviation? 2.75  
 (b) For two observations, show that standard deviation is the half of the range. 3  
 (c) Show that variance is independent of origin but not of scale. 3
- 3 (a) Define probability, probability function and probability density function. 2.75  
 (b) State and prove Baye's theorem. 3  
 (c) Two unbiased dice are tossed simultaneously. What is the probability of getting a total of point 3 or even numbers from both the dice? 3

**SECTION: B**

- 4 (a) Define Binomial distribution. Write down few of its properties. 2.75  
 (b) Find mean, variance and coefficient of skewness ( $\beta_1$ ) of Poisson distribution. 3  
 (c) If electricity power failures occur according to a Poisson distribution with an average of failures every twenty weeks, calculate the probability that there will not be more than one failure during a particular week. 3
- 5 (a) What is correlation? Write down the properties of correlation. 2.75  
 (b) Derive the correlation co-efficient and interpret it. 3  
 (c) If X and Y are independent then show that they are uncorrelated. 3
- 6 (a) Define null hypothesis and alternative hypothesis. 2.75  
 (b) Describe how will you test the null hypothesis  $H_0: \mu = \mu_0$  vs.  $H_1: \mu \neq \mu_0$ . 3  
 (c) Distinguish between normal test and t-test. 3

Time: 2 Hours

Full Marks: 35

[Answer FOUR (04) questions taking TWO (02) from each Section]

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### Section A

1. (a) What is meant by dispersion? What are the important measures of dispersion? 2.75
- (b) If  $\bar{x}$  and  $s$  denote respectively the mean and standard deviation of a set of  $n$  observations, show that  $\bar{x}\sqrt{(n-1)} \geq s$ . 3
- (c) Calculate the mean and variance of the first  $n$  natural numbers. 3
  
2. (a) Define with example event, mutually exclusive event and sample space. 2.75
- (b) State and prove the additive law of probability for two events. 3.5
- (c) Three events  $A_1, A_2$  and  $A_3$  are mutually exclusive and their union is the sample space  $S$ . 2.5  
 If  $P(A_1) = \frac{3}{2}P(A_2), P(A_2) = 2P(A_3)$ , then find  $P(A_1), P(A_2)$  and  $P(A_3)$ .
  
3. (a) Define binomial distribution. 2.75
- (b) If  $X$  is distributed as binomial, show that mean  $\geq$  variance. 3
- (c) Let three unbiased coins are tossed at a time. What is the probability that (i) no head, (ii) at least two heads will appear? 3

### Section B

4. (a) How do you distinguish between correlation and regression? 2.75
  - (b) Show that correlation coefficient is independent of change of origin and scale of the variables. 3
  - (c) Calculate the rank correlation coefficient from the following data on hourly sales ( $x$ ) and expenses ( $y$ ) of 10 stores 3
- |     |    |    |    |    |    |    |    |    |    |    |
|-----|----|----|----|----|----|----|----|----|----|----|
| $x$ | 50 | 50 | 55 | 60 | 65 | 65 | 65 | 60 | 60 | 60 |
| $y$ | 11 | 13 | 14 | 16 | 16 | 15 | 15 | 14 | 13 | 13 |
- 
5. (a) What is a scatter diagram? What are the uses of scatter diagram? 2.75
  - (b) Discuss the principles of least square method. 3
  - (c) Estimate the parameters of the simple linear regression model using ordinary least square method. 3
  
  6. (a) Define (i) parameter and (ii) level of significance. 2.75
  - (b) Prices of shares in (Tk.) of a company on the different days in a month were found to be 66, 65, 69, 70, 69, 68, 71, 63, 64, and 68. Test whether the mean price of shares in the month is 65 or not (critical value at 5% level of significance is 2.26). 3
  - (c) The mean yields (in gm) of two sets of plots and their standard deviation are given below. Test the hypothesis that whether the difference in the mean yields of the two set of plots is significant or not. 3

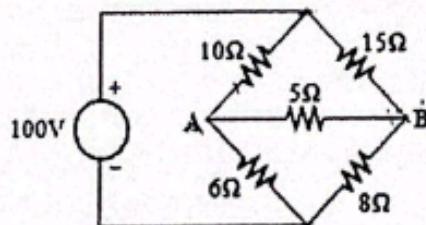
Set of 40 plots		Set of 60 plots	
Mean yield/plot	1259	1243	
Standard deviation	34	28	

### Section A

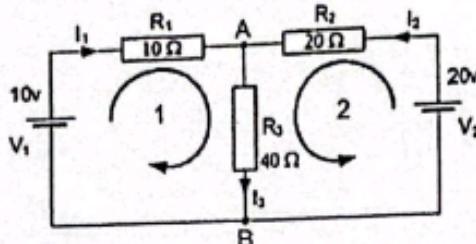
- 1(a) Define electric field, electric dipole and dipole moment. 3
- (b) Show that  $\tau = \vec{P} \times \vec{E}$  for an electric dipole is placed in a uniform electric field  $\vec{E}$ . 2.75
- (c) An electric dipole of moment  $3 \times 10^{-9}$  cm is placed in a uniform field intensity  $1.5 \times 10^5$  NC $^{-1}$ . What does the maximum torque the field exert on the dipole? 3
- ~~2(a)~~ State and prove Gauss's law in electrostatics. 4.75
- (b) A long cylinder of radius  $a$  is uniformly charged with charge density  $\lambda$  per unit length. Find the field  $E$  at points inside and outside the cylinder. 3
- (c) When do we apply Gauss's law? 1
- ~~3(a)~~ State and prove Ampere's law for arbitrary path enclosing electric currents. 5.75
- (b) A solenoid has length 1.65 m and inner diameter 2.55 cm it carries a current 4.35 A. It consists of five closed packed layers, each with 150 turns along. What is the magnetic field  $B$  at its enter? 3
- 4(a) Explain current density and drift velocity of a carrier. 2
- (b) Establish the relation between drift velocity and current density. 3
- (c) Calculate the drift velocity of free electron in copper from the following data:  
Current density =  $5 \times 10^6$  Am $^{-2}$ , density of copper =  $9000\text{kg/m}^3$ , At wt. of copper 64gm/mole, Avogadro number =  $6 \times 10^{23}$  atoms/mole, electron charge =  $1.6 \times 10^{-19}$  C. 3.75

### Section B

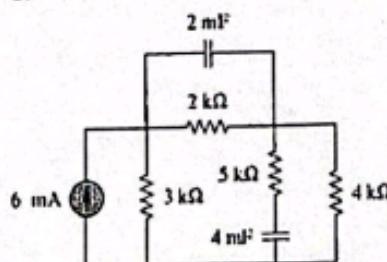
- ~~5(a)~~ State and prove maximum power transfer theorem. 4
- (b) Apply Thevenin's theorem to calculate the current through the  $5\Omega$  resistor of the circuit below: 4.75



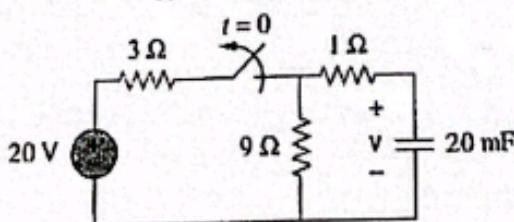
- 6(a) What is alternating emf? 2  
 (b) State and explain Kirchhoff's voltage law. 3  
 (c) Consider the following circuit. Find the current flowing in the  $R_3$  resistor. Also calculate the voltage across it. 3.75



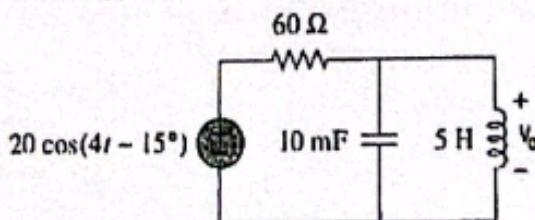
- 7(a) Show the current-voltage, voltage-current relationship and the energy stored in the capacitor. 3  
 (b) Obtain the energy stored in each capacitor in figure below under dc conditions. 2.75



- (c) The switch in the circuit in figure below has been closed for a long time, and it is opened at  $t = 0$ . Find  $v(t)$  for  $t \geq 0$ . Calculate the initial energy stored in the capacitor. 3



- 8(a) Explain reactance and impedance of an AC circuit. 3  
 (b) Show the voltage-current relation for an inductor and a capacitor in the time domain and in the frequency domain with phasor diagram. 3.75  
 (c) Determine  $v_o(t)$  in the circuit in figure below: 2



Section-A

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- 1.a) What is electric dipole? 1
- b) How do you calculate the electric field intensity due to an electric dipole? 4%
- c) An electric dipole consists of charges +2e and -2e separated by 0.87 nm. It is in an electric field of strength  $4.4 \times 10^6$  N/C. Calculate the magnitude of the torque on the dipole when the dipole moment is (i) parallel to (ii) perpendicular to and (iii) antiparallel to the electric field. 3
- 2.a) Write-down the few applications of Gauss law. 1½
- b) Applying Gauss's law to calculate the electric field intensity due to a uniformly charged sphere (non-conducting) at points (i) outside the sphere, (ii) at the surface of the sphere, (iii) Inside the sphere 5
- c) Draw the curve for the variation of the electric field intensity as function of radial distance due to a uniformly charged sphere (non-conducting) and discuss the results. 2½
- 3.a) Define capacitance and a capacitor. On what factor does the capacitance depend? 1½+1½
- b) Find an expression for the capacitance of a parallel plate capacitor. 3
- c) A parallel plate capacitor consists of two square metal plates with 5.0 cm of side separated by 1.0 cm. A Sulphur slab of 6.0 mm thick and with  $k = 4$  is placed on the lower plate, calculate the capacitance. 2½
- 4.a) Explain the following terms (i) insulator, (ii) semiconductor and (iii) conductor using the band-gap. 1½
- b) State and explain Kirchhoff's laws in an electric network. Apply these laws to find an expression for the current through the galvanometer in an unbalanced Wheatstone's bridge. 2+3½
- c) The current in a simple series circuit is 5A. When an additional resistance of  $2\Omega$  is inserted, the current drops to 4A. What was the resistance of the original circuit? 2

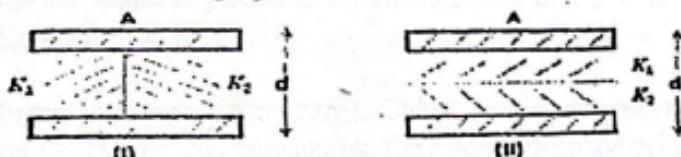
Section-B

- 5.a) State and explain Faraday's law of electromagnetic Induction. 2
- b) What are the coefficients of self-inductance and mutual inductance? Find an expression for the self inductance of a solenoid. 2+3
- c) A 10 cm long solenoid having an air core has 100 turns and area of cross section  $5 \text{ cm}^2$ . Find the coefficient of self-inductance of the solenoid. 1½
- 6.a) Explain the Seebeck effect. Write down the names of thermos electrically negative and positive metals in thermos couple. 1½
- b) How does Peltier effect differ from Joule heating effect? 2
- c) What are the natural temperature and inversion temperature? 2
- d) The emf (microvolts) in a lead-iron thermocouple, one junction of which is at  $0^\circ\text{C}$  is given by  $E = 1874t - 3.4t^2$ , where  $t$  is the temperature in degrees centigrade. Calculate the natural temperature, Peltier coefficient and Thomson coefficients. 3
- 7.a) Derive an equation for the growth of charge in a dc circuit with inductance, capacitance and resistance in series. 6
- b) Using the above theory, explain the damped oscillatory case with figure. 2½
- 8.a) What is alternating emf? 1
- b) An alternating emf  $E = E_0 \cos \omega t$  is applied to a circuit containing a resistance  $R$  and an inductance  $L$  in series. Find the current at any instant. 4½
- c) Define the reactance and impedance of ac circuit. 1½
- d) In a series  $LR$  circuit,  $E = 100$  volts,  $L = 25 \text{ mH}$  and  $R = 50\Omega$ . Calculate (i) the amplitude of the current, and (ii) the phase difference between the applied emf and current. 2

[N.B. Answer any six questions taking THREE from each of the Section]

### Section-A

1. a) Define electric flux.  
 b) Derive an expression for the capacitance of a spherical capacitor.  
 c) The area of each plate of a parallel plate capacitor is  $A$ , and their separation is  $d$ . It is filled with two dielectrics of dielectric constants  $K_1$  and  $K_2$ . Calculate the capacitance when the dielectrics are filled as in following figures.



2. a) State and prove Gauss's law in electro statistics.  
 b) A long cylinder of radius  $a$  is uniformly charged with charge density  $\lambda$  per unit length. Find the field  $E$  at points inside and outside the cylinder.  
 c) When do we apply Gauss's law?
3. a) What is dipole moment? Obtain an expression for the potential due to an electric dipole.  
 b) Show that  $\tau = \vec{P} \times \vec{E}$  for an electric dipole is placed in a uniform electric field  $\vec{E}$ .  
 c) An electric dipole consist of two opposite charges of magnitude  $q = 2.0 \times 10^{-6} C$  separated by 2.0cm. The dipole is placed in an external field of  $E = 2.0 \times 10^5 N/Coul$ . Calculate the maximum torque on the dipole.
4. a) What is current density and drift velocity of a charge carrier?  
 b) Establish the relation between drift velocity and current density.  
 c) Calculate the drift velocity of free electron in copper from the following data:  
 current density =  $5 \times 10^6 Am^{-2}$ , density of copper =  $9000 kg/m^3$ , At. wt. of copper 64 gm/mole,  
 Avogadro number =  $6 \times 10^{23}$  atoms/mole, electron charge =  $1.6 \times 10^{-19} C$ .

### Section-B

5. a) State and prove Ampere's law. Apply it to calculate the magnetic field due to a solenoid.  
 b) A solenoid is 1.0 m long and 3.0cm in mean diameter. It has 5 layers of windings of 850 turns each and carries a current of 5A. Calculate  $B$  at its center.
6. a) What are the Thomson effect and Peltier effect?  
 b) Explain the thermoelectric diagrams.  
 c) The emf of a thermocouple, one junction is kept at  $0^\circ C$ , is given by  $E = at + bt^2$ . Determine the neutral temperature, temperature of inversion, and the Peltier and Thomson coefficients.
7. a) Obtain an expression for the growth and decay of current in a dc circuit containing a resistance and inductance.  
 b) An emf 10 volts is applied to a circuit having a resistance of 10 ohms and an inductance of 0.5 Henry. Find the time required by the current to attain 63.2% of its final value.
8. a) Obtain the expression for the mean value and the root mean square value of an alternating current.  
 b) What is resonance frequency? Obtain an expression for it in case of LCR series circuit. Explain it for various  $R$  values.  
 c) Find the resonance frequency of an LCR series circuit for  $L = 10 mH$ ,  $C = 0.02 \mu F$  and  $R = 20\Omega$ .

### Section A

1. (a) Define electric field, electric dipole, and dipole moment. 2  
 (b) Find the potential energy of an electric dipole placed in a uniform external electric field. 2  
 (c) A neutral water molecule in its vapor state has an electric dipole moment of magnitude  $6.2 \times 10^{-30}$  c.m. (i) How far apart are the molecule's center's of positive and negative charge? (ii) If the molecule is placed in an electric field of  $1.5 \times 10^4$  N/C, what maximum torque can the field exert on it? 3.75
  
2. (a) Prove that, for a point charge, Gauss' law is equivalent to Coulomb's law. 3.25  
 (b) Apply Gauss' law to calculate the electric field for cylindrical symmetry. 3.5  
 (c) Write down the few applications of Gauss' law. 2
  
3. (a) Define capacitor and capacitance. 3  
 (b) Deduce the relation  $C = \frac{\epsilon_0 A}{d}$  for a parallel plate capacitor, where the symbols have their usual significance. 4  
 (c) A storage capacitor on a Random Access Memory (RAM) chip has a capacitance of  $55 \mu\text{F}$ . If the capacitor is charged to 5.3 V, how many excess electrons are on its negative plate? 1.75
  
4. (a) State Kirchhoff's laws of distribution in an electric network. 4  
 (b) A metal rod of length 25 cm has resistance  $7.5 \times 10^{-6} \Omega$ . The diameter of the rod is 0.40 cm. Calculate the resistivity of the metal. 2.75  
 (c) Write short note about semiconductor. 2

### Section B

5. (a) State and explain Faraday's law of electromagnetic induction. 3  
 (b) Calculate the magnetic field inside a long straight wire with current. 3.5  
 (c) A solenoid has length 1.23 m and inner diameter 3.55 cm and it carries a current 5.57 A. It consists of five closed packed layers, each with 850 turns along length. What is the B at its center? 2.25
  
6. (a) Write down the conditions for a moving coil galvanometer to be dead beat. 2  
 (b) What is mutual inductance? Calculate the mutual inductance between two coaxial solenoids. 4.75  
 (c) A solenoid of length 30 cm and area of cross-section  $10 \text{ cm}^2$  has 1000 turns wound over a core of constant permeability 600. Another coil of 500 turns is wound over the same coil at its middle. Calculate the mutual inductance between them. 2
  
7. (a) What are thermocouple and thermal emf? 3  
 (b) Define neutral temperature and temperature of inversion for thermocouple. 3  
 (c) Calculate the maximum emf in a Fe-Pb thermocouple, the cold junction of which is kept at 0°C. Given  $a = 13.8 \mu\text{V}/^\circ\text{C}$  and  $b = -0.015 \mu\text{V}/(^\circ\text{C})^2$ . 2.75
  
8. (a) Define reactance and impedance of an AC circuit. 2  
 (b) Analyze a series LCR circuit and explain the phenomenon of resonance. 4  
 (c) Find the resonance frequency of an LCR series circuit for  $L = 10 \text{ mH}$ ,  $C = 0.02 \mu\text{F}$  and  $R = 20 \Omega$ . 2.75

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B.Sc. Engg.(CSE) 1<sup>st</sup> Year EVEN Semester 2016**  
**Course: PHY 1221 (Applied Electricity and Magnetism)**

Time: 3 Hrs.      Full Marks: 52.5

[N.B. Answer SIX questions taking at least THREE from each part]

Part A

- |  |       |
|--|-------|
| 1.a) State superposition principle for electric charges.   | 1     |
| b) Derive an expression for the electric field at a point on the axial line due to an electric dipole.   | 4.75  |
| c) An electric dipole of moment $2 \times 10^{-8}$ Cm is placed in a uniform field intensity $1.5 \times 10^5$ NC <sup>-1</sup> (i) What maximum torque does the field exert on the dipole? (ii) How much work is done on turning the dipole end to end? | 3     |
| 2.a) State and prove Gauss's law in electrostatics.  | 5     |
| b) Charge is distributed uniformly over the surface of a sphere. Use Gauss's law to find the electric field at the points (i) Outside of the sphere (ii) On the surface of the sphere  | 3.75  |
| 3.a) Define capacitor. Classify the capacitors. Write down the major uses of capacitor.  | 1+1+1 |
| b) Derive an expression for the energy stored by a charged capacitor.  | 3     |
| c) The parallel plates of an air-filled capacitor are 1 cm apart. What will be the area A of each plate if capacitance is to be $0.25 \mu F$ ?   | 2.75  |
| 4.a) Establish the relation between current density and electron drift velocity.   | 3.5   |
| b) Deduce the condition for the balance of a Wheatstone's bridge.  | 3.5   |
| c) Write short note about Superconductor.  | 1.75  |

Part B

- |   |      |
|---|------|
| 5.a) State and prove Ampere's law. Apply it to calculate the magnetic field due to a solenoid.  | 3+3  |
| b) Define self-inductance and mutual inductance.  | 2.75 |
| 6.a) Describe a moving coil galvanometer. Explain how current can be measured with it.  | 4    |
| b) What are the differences between ballistic and deadbeat galvanometer?  | 2    |
| c) Prove that the charge sensitivity of a B.G. is $2\pi/T$ times the current sensitivity.   | 2.75 |
| 7.a) Briefly describe about Seebeck and Peltier effects.  | 4    |
| b) Write down the laws of addition of thermal electromotive forces.   | 4.75 |
| 8.a) A series circuit containing an inductor L and a resistor R is connected to a battery. Obtain the expression for the rate of decay of current.  | 4.75 |
| b) An e.m.f. 10V is applied to a circuit having a resistance of $10\Omega$ and inductance of $0.5H$ . Find the time required by the current to attain 63.2% of its final value. What is the time constant of the circuit? | 4    |

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B.Sc. Engg. Part-I Even Semester Exam - 2015**  
**Course: PHY1221 (Applied Electricity and Magnetism)**  
**Full Marks: 52.5      Time: 3 Hours**

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**(Answer any 6 questions not taking more than 3 from each Part)**

**Part A**

- |   |      |
|---|------|
| 1.(a) Define an electric dipole and its moment.   | 1    |
| (b) Find the electric field $\bar{E}$ at a point P due to a dipole at a distance $r$ from the midpoint of the dipole.   | 5    |
| (c) A water molecule in its vapour state has an electric dipole moment $6.2 \times 10^{-30} \text{ cm}$ . What is the electric field $\bar{E}$ at a distance $r$ of 1.1 nm from the molecule on the dipole axis?  | 2.75 |
| 2.(a) What is electric flux?  | 2    |
| (b) Obtain Coulomb's law from Gauss's law.  | 3.50 |
| (c) A point charge of $1.8 \mu\text{C}$ is at the centre of a spherical Gaussian surface of radius 55 cm. What is the net flux through the surface?   | 3.25 |
| 3.(a) Calculate the total enclosed charge $q$ for a parallel plate capacitor with dielectric using Gauss's law.   | 5    |
| (b) A parallel plate capacitor of plate area $11.5 \text{ cm}^2$ and plate separation 1.24 cm. A potential difference 85.5 V is applied between the plates. The battery is then disconnected, and a dielectric slab of thickness 0.78 cm and dielectric constant 2.61 is placed between the plates. What is the capacitance with the slab in place? | 3.75 |
| 4.(a) What is the current density and drift velocity of the charge carrier?   | 2    |
| (b) Establish the relationship between the current density and drift velocity.  | 4    |
| (c) What is the drift velocity of the conduction electrons in a copper wire of diameter 0.5 mm and length 20 m, when it is connected across the battery of 1.5V and the internal resistance $1.25\Omega$ .<br>(Here $\rho = 8.96 \times 10^3 \text{ kg/m}^3$ , $n = 8.49 \times 10^{28} \text{ m}^{-3}$ )   | 2.75 |

**Part B**

- |  |      |
|--|------|
| 5.(a) State and explain Faraday's law of induction. Deduce its differential form.  | 3.75 |
| (b) Find the mutual inductance of two co-axial coils.  | 5    |
| 6.(a) What do you mean by thermal emf?   | 2    |
| (b) What is Thomson effect?  | 3    |
| (c) Find an expression of the thermo-electric power.   | 3.75 |
| 7.(a) Find expression for the growth and decay of charges of a capacitor through resistor with constant emf.   | 3.75 |
| (b) What is the time constant in an RC circuit? Show that the time constant has the unit of time.  | 2    |
| (c) In an RC circuit $R = 0.4 \times 10^6 \text{ ohm}$ and $C = 2.5 \times 10^{-6} \text{ F}$ , in what time will the charge in the capacitor decay one fourth of its initial value?   | 3    |
| 8.(a) An alternating emf is applied to a circuit consisting an inductor, capacitor and resistor in series. Obtain the expression for the current and impedance.  | 5.75 |
| (b) A circuit consists of a non-inductive resistance of $50\Omega$ , an inductance of $0.3\text{H}$ and a resistance of $2\Omega$ and a capacitor of $40\mu\text{F}$ in series and is supplied with 200 volts at 50 Hz. Find the impedance and the current in the circuit. | 3    |

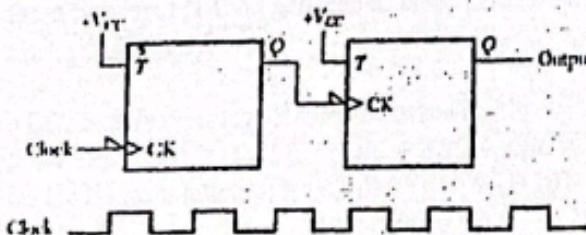
[N.B. Answer SIX questions taking at least THREE from each Section.]

### Section A

- |  |      |
|--|------|
| 1. (a) Find $(45)_{10} - (83)_{10}$ using two's complement format with 8-bit numbers. Then convert your result back to decimal.  | 3    |
| (b) Add $(65)_{10} + (72)_{10}$ using 8-bit sign-magnitude format for the numbers. Convert your result to decimal. Is your answer correct? Why or why not?   | 5    |
| (c) Write the gray code for $(1011)_2$ .   | 0.75 |
| 2.(a) Convert $(1000\ 0110)_{BCD}$ to decimal, binary & octal.   | 3    |
| (b) Simplify $Z = A' C (A' B D)' + A' B C' D' + A B' C$ using Boolean algebra.   | 2.75 |
| (c) State & prove De Morgan's theorems with the help of truth tables.  | 3    |
| 3. (a) Design and explain a full adder in detail with circuit diagram and truth table.   | 4    |
| (b) Design a combinational logic circuit to compare two 2-bit binary numbers A and B and to generate the outputs $A < B$ , $A = B$ and $A > B$ . Is there a way to derive the third output from the first two outputs? | 4.75 |
| 4. (a) Simplify the following Boolean expression using Quine-McCluskey technique<br>$f(A,B,C,D) = \sum m(0,1,3,7,8,9,11,15)$ .   | 6    |
| (b) List out the advantages and disadvantages of Quine-Mc Cluskey Method.  | 2.75 |

### Section B

- |  |      |
|--|------|
| 5(a) What is latch and flip-flop?  | 2    |
| (b) Explain the master slave S-R flip-flop with timing diagram in detail.  | 6.75 |
| 6(a) Draw a circuit diagram of a J-K latch and explain its operation.  | 4    |
| (b) Plot the output waveforms referenced to the clock signal assuming the initial contents of all FFs is Q = 0. Assume all FFs are edge triggered. | 4.75 |



- |  |      |
|--|------|
| 7.(a) State advantages and disadvantages of TTL.   | 2    |
| (b) Draw the circuit diagram of DTL-NAND gate.   | 3    |
| (c) Design a NOT gate using MOSFET.  | 3.75 |
| 8.(a) Draw the block diagram of a system to interface a computer to the analog world so that the computer can monitor and control a physical variable and explain the functions of each block. | 4    |
| (b) What do you mean by resolution and accuracy for a DAC?   | 1.75 |
| (c) Draw the block diagram of an ADC and discuss its basic operation.  | 3    |

Part A

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1. (a) Do the following conversions: 4  
 i)  $(378)_{10}$  to 16 bit binary number;  
 ii)  $(1010110.1100)_2 = (?)_{10}$ ;  
 iii)  $(10101100)_2 = (?)_8$ ;  
 iv)  $(743)_{16} = (?)_2$ .
- (b) Compare between BCD and Binary code. 2
- (c) What is Gray code? Explain with examples, how do you convert binary to Gray and Gray to binary? 2.75
2. (a) Subtract  $(100111)_2$  from  $(001100)_2$  using 2's complement method. Why do you need 2's complement method? 2
- (b) Apply the input waveforms of fig-1 to a NOR gate, and draw the output waveform. Then repeat the output waveform with C hold permanently LOW. 2

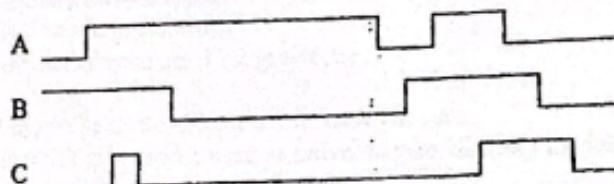


Fig-1

- (c) Determine the truth table for the circuit of fig-2. 2

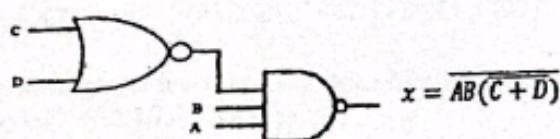


Fig-2

- (d) Show that a two-input NAND gate can be constructed from two-input NOR gate. Simplify the following:  $(\overline{A} + \overline{B})(\overline{A} + \overline{B})$  2.75
3. (a) What is DeMorgan's theorem? Explain with truth table. 2.75
- (b) Simplify the expression  $x = \bar{A}\bar{B}\bar{C} + \bar{A}BC + ABC + A\bar{B}\bar{C} + A\bar{B}C$  using Boolean algebra. 2
- (c) Minimize the Boolean function  $f(a,b,c,d) = \sum_M(1,4,6,8,10)$  4
4. (a) Simplify the following expression using K-map method  
 $f(A,B,C,D) = \sum_M(7,9,10,11,12,13,14,15)$  5
- (b) Design the circuit corresponding to the truth table shown in Table-1. 3.75

A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Table-1

Part B

- |  |      |
|--|------|
| 5. (a) Explain the clocked S-R flip-flop in detail.  | 6    |
| (b) Explain D type flip-flop.  | 2.75 |
| 6. (a) Draw the basic DTL gates to implement NAND gate. Explain its operation.   | 2    |
| (b) Discuss the characteristic of TTL gates. Explain the operation of open collector TTL gates.                          | 2.75 |
| (c) Where ECL is more suitable? Draw and explain ECL to implement OR and NOR gates.                                      | 4    |
| 7. (a) Define transducer, analog-to-digital converter (ADC) and digital-to-analog converter (DAC).                       | 3    |
| (b) Draw the basic R/2R ladder DAC of 4-bit and write the $V_{OUT}$ expression.  | 2    |
| (c) Assume the $V_{REF} = 5V$ for the 4-bit DAC. What are the resolution and full-scale output of this converter?        | 1.75 |
| (d) An 8-bit DAC has an output of 3.92 mA for an input of 01100010. What are the DAC's resolution and full-scale output? | 2    |
| 8. (a) What is timer? What are the different applications of timer?  | 3    |
| (b) Design an monostable multi-vibrator using 555 timer and explain its operation.                                       | 5.75 |

[N.B. Answer SIX questions taking THREE from each part]

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**Part-A**

1. (a) Do the following conversions: 4  
 (i)  $(10101011.1101)_2 = (?)_{10}$       (ii)  $(20345.125)_{10} = (?)_2$       (iii)  $(80914.25)_{10} = (?)_8$   
 (iv)  $(3AE8F.2D)_{16} = (?)_8$       (v)  $(1011001110)_2 = (?)_4$
1. (b) Add  $(110111)_2$  with  $(100111)_2$ . Subtract  $(100110)_2$  from  $(110011)_2$  using 2's complement method. 3
1. (c) Represent  $(-17)_{10}$  in sign magnitude, 1's complement and 2's complement representation. 1.75
2. (a) Write the procedure to convert a binary code to gray code with example. 4  
 (b) With the help of example explain excess-3 code. 3  
 (c) Write the BCD code for  $(9248)_{10}$ . 0.75  
 (d) How can you easily generate 3 bit gray code. 1
3. (a) Define and draw the truth table of a 3-input X-OR gate. 2.75  
 (b) Show that NAND gate can be used as universal gate. Simplify the following using De Morgan's theorem  

$$\overline{A+B} \overline{\overline{A}+B}$$
  
 (c) Simplify the following Boolean expressions to a minimum number of literals: 3  
 (i)  $ABC + A'B + ABC' + AC$     (ii)  $A'B(D' + CD) + B(A + A'CD)$
4. Simplify the following logic function using Quine-McCluskey technique 8.75  
 $f(A,B,C,D) = \sum m(0,1,3,7,8,9,11,15)$

**Part-B**

5. (a) Write the difference between asynchronous and synchronous system. 1.75  
 (b) Explain the operation of a positive-edge triggered SR flip-flop by timing diagram. 4  
 (c) Discuss how an SR latch is converted into D-latch. 3
6. (a) Explain the operation of a JK flip-flop using timing diagram. 3.75  
 (b) Mention the limitations of a JK flip-flop. 2  
 (c) Describe how a D-latch operates differently from an edge-triggered D flip-flop. 3
7. (a) Discuss the operation of an 8-bit DAC using op-amp summing amplifier with binary weighted registers. 3  
 (b) Define R/2R ladder DAC with basic circuit diagram. Write the benefits of R/2R circuit. 3  
 (c) Briefly discuss the operation of the digital ramp ADC. 2.75
8. (a) Draw the block diagram of a 555 timer and explain about its each pin. 3  
 (b) Design an astable multi-vibrator using 555 timer and explain its operation. 5.75

Section A

1. (a) What are the advantages of encoding a decimal number in BCD as compared to straight binary? What is its disadvantage? 2
- (b) What range of decimal values can be represented by a four-digit octal number? 1.75
- (c) A typical PC uses a 20-bit address code for its memory locations- 3
- i) How many Hex digits are needed to represent a memory address?
  - ii) What is the range of addresses?
  - iii) What is the total number of memory locations?
- (d) Perform the subtractions  $(01001 - 11010)_2$  and  $(10010 - 10011)_2$  using 2's complement system. 2
2. (a) Draw the logic diagram and truth table of OR, NOR and XOR gate using NAND gate only. 3
- (b) Simplify the following Boolean expression 3
- i)  $X = ABC + A'BC + AC + AC'$
  - ii)  $A'B(D' + CD) + AB + A'BCD$
- (c) Which coding technique is good for error detection? Give example. Convert  $(10110)_2 = (?)_{\text{gray}}$ . 2.75
3. (a) Minimize the following function:  $f(a, b, c, d) = \sum m(1, 3, 4, 7, 11) + d(5, 12, 13, 14, 15)$  3
- (b) Define prime implicant with example. 1.75
- (c) Minimize the following function using Quine-McCluskey method. 4
- $$f(a, b, c, d) = \sum_m (0, 1, 2, 4, 6, 8, 12, 14)$$
4. (a) Define the following terms: i) Fan out ii) Noise margin 2.75
- (b) Draw and explain the circuit operation of 2 digit TTL NAND gate. 3
- (c) Design a two input CMOS NAND gate with necessary diagram and truth table. 3

Section B

5. (a) Write down some benefits of clocked flip-flop. Discuss the circuit diagram of the edge triggered SR flip-flop with timing diagram. 4
- (b) Mention some applications of Latch. 1.75
- (c) Briefly explain the operation of master-slave flip-flop using logic and timing diagram. 3
6. (a) Draw the internal functional diagram of a 555 timer and explain its basic operation. What are the applications of 555 timer? 4.75
- (b) Draw the pin configuration of a 555 timer IC and explain the function of each pin. 4
7. (a) Define resolution or step size of a D/A converter. For a DAC, if step size is 0.1 V, then what will be the output voltage for a digital input 0001. 2.75
- (b) What is the advantage of R/2R ladder DAC over weighted registers DAC? Draw and explain the basic operation of R/2R ladder DAC. 3
- (c) What is the main advantage of a SAC over digital ramp ADC? An 8-bit SAC has resolution of 20 mV. What will its digital output be for an analog input of 2.17 V? Illustrate with diagram. 3
8. Write short notes on the following (any three): 8.75
- (a) ECL NOR/OR gate
- (b) Shift register
- (c) Digital Ramp ADC
- (d) 3 bit counter

University of Rajshahi  
 Department of Computer Science and Engineering  
 B.Sc. Engg.(CSE) 1<sup>st</sup> Year Even Semester 2019  
 Course: CSE1211 (Introduction to Digital Electronics)  
 Time: 3 Hrs. Full Marks: 52.5

[N.B. Answer SIX questions taking at least THREE from each Section.]

Section A

- |  |           |
|--|-----------|
| 1. (a) Perform subtraction using 2's complement method $(85-47)_{10}$ .  | 3         |
| (b) convert $(541.203)_6$ to base 5, base 8 and base 10.   | 3         |
| (c) Write the binary code for the gray code 10110111.  | 0.75      |
| (d) Represent the decimal number 28 to excess-3 and BCD code.  | 2         |
| 2. (a) Given the boolean function $K = AB + A'B' + B'C$<br>Then i) implement it with AND, OR and NOT gates<br>ii) implement it with only OR and NOT gates.   | 3         |
| (b) Show that the dual of the exclusive-OR is equal to its complement.<br>Simplify the following expression<br>$z = \bar{A}B\bar{C} + A\bar{B}\bar{C} + B\bar{C}D$   | 3.75      |
| (c) What are don't care terms? Explain with example.   | 2         |
| 3. (a) What is parity bit? Design 3-bit odd parity generator and checker.<br>(b) Implement a full adder using two half adder.  | 6<br>2.75 |
| 4. (a) Design a logic circuit whose output is HIGH only when a majority of inputs A, B and C are LOW.<br>(b) Simplify the following Boolean function using K-map and realize with basic gates:<br>$F(A, B, C, D) = \sum m(1, 5, 6, 12, 13, 14) + \sum d(2, 4)$ . | 2.75<br>6 |

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Section B

- |   |      |
|---|------|
| 5(a) Show the logic diagram of a clocked RS flipflop with four NAND gates.  | 3    |
| (b) With the help of timing diagram, explain the operation of positive edge triggered JK FF.                                | 3    |
| (c) What are the advantages of a master-slave JK FF? Mention some limitations of SR FF.                                     | 2.75 |
| 6(a) What is the basic difference between latch and flip-flop?  | 1    |
| (b) Define setup time, propagation delay and hold time for flip-flop using proper timing diagram.                           | 2.75 |
| (c) Draw the circuit diagrams and discuss the operation of D flip-flop and T flip-flop.                                     | 5    |
| 7.(a) Draw the TTL NAND gate circuit and explain its operation.   | 3    |
| (b) What is current sourcing and current sinking action?  | 1.75 |
| (c) Draw and explain a CMOS NOR gate circuit.   | 4    |
| 8.(a) Discuss the operation of a 555 timer IC based monostable multi-vibrator.  | 3    |
| (b) A certain binary-weighted-input DAC has a binary input of 1101. If a HIGH = +3.0 V and a LOW = 0 V, what is $V_{out}$ ? | 1.75 |
| (c) Draw the block diagram of a successive-approximation ADC and discuss its basic operation with a flow-chart.             | 4    |

University of Rajshahi

Dept. of Computer Science and Engineering

B.Sc. Engg. Part-I, Even Semester, Examination 2020

Course Code: ECON 1211 Course Title: Engineering Economics

Full Marks: 35

Time: 2 Hours

[N.B. Answer FOUR questions taking at least TWO from each Section.]

Section A

1. (a) Define engineering economy. Why is it important for engineers to study engineering economy? 4  
(b) Distinguish, with an example, between simple and compound interest rates. 4.75
2. (a) What is cash flow? Draw cash flow diagrams from both a borrower's point of view and a lender's point of view. 2  
(b) Explain the concept of arithmetic gradient with figures. 2  
(c) A construction firm pays \$5,000.00 for the first year of a maintenance service contract that increases by \$1,000.00 in each subsequent year until year six. If the interest rate is 6%, calculate the present worth of the uniform annual series and the gradient. 4.75
3. (a) Distinguish between nominal interest rate and effective interest rate. 2  
(b) Three different bank loan rates for electric generation equipment are listed below. Determine the effective rate on the basis of the compounding period for each rate.  
i) 9% per year, compounded quarterly.  
ii) 9% per year, compounded monthly.  
iii) 4.5% per 6 months, compounded weekly. 4.75  
(c) What is effective annual interest rates? 2

Section B

4. (a) What is the primary purpose of a public sector project? 1  
(b) Explain how public projects are different from private projects. 3  
(c) Distinguish between the conventional B/C ratio and the modified B/C ratio for a single project. 4.75
5. (a) What do you mean by inflation? How does inflation happen? 4  
(b) Derive and show the relationship between market interest rate, real interest rate and the inflation rate. 2  
(c) Money in a medium-risk investment makes a guaranteed 8% per year. Inflation rate has averaged 5.5% per year. What is the real rate of return on the investment? 2.75
6. (a) What are the main elements of after tax cash flows? 2  
(b) A medium-sized profitable corporation may buy a \$15,000 used pickup truck for use by the shipping and receiving department. During the truck's 5-year useful life, it is estimated the firm will save \$4000 per year after all the costs of owning and operating the truck have been paid. Truck salvage value is estimated at \$4500.  
i) What is the before-tax rate of return?  
ii) What is the after-tax rate of return on this capital expenditure? Assume straight-line depreciation. 6.75

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B. Sc. (Engg.) Part-I Even Semester Examination 2019**  
**Course: ECON 1211 (Economics)**  
**Full Marks: 35 Time: 2 Hours**

[Answer any Four questions taking two from each section]

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**Section A**

1. a) Define economics. Distinguish between microeconomics and macroeconomics. 4  
b) What are the central economic problems of an economy? How these problems are solved in different economic systems? 4.75
2. a) Define demand and supply. 2  
b) Derive demand and supply curves from corresponding demand and supply schedules. 4
3. a) What is elasticity of demand? Distinguish between arc elasticity and point elasticity with examples. 2.75  
b) What are the characteristics of perfect competition and monopoly markets? 3  
c) Draw TC, AC, MC and TFC curves. 3
3. a) Define market equilibrium and present market equilibrium graphically. How is equilibrium restored in a market? 2.75

**Section B**

4. a) Distinguish between GDP and GNP with example. 3  
b) What is meant by Aggregate Demand (AD)? 1.75  
c) What is double counting problem? Give an example. 4
5. a) Explain the concepts of frictional, structural and cyclical unemployment with example. 3  
b) What is Philips curve? Draw short-run and long-run Philips curves. 3  
c) What is tax? Distinguish between direct tax and indirect tax with example. 2.75
6. a) What is a development plan? Write the principal characteristics of a development plan? 3  
b) Write the phases of development plan in Bangladesh since independence. 4  
c) What are the advantages of planning approach? 1.75

# University of Rajshahi

## Department of Computer Science and Engineering

B.Sc. Engineering Part-1 EVEN Semester, Examination - 2018

Course Code: ECON-1211

Course Title: Economics

Full Marks: 35

Time: 2 Hours

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[N.B.: Answer Four (04) Questions taking any Two (02) Questions from each Section]

### Section-A

- |   |      |
|---|------|
| 1.(a) Define economics system. What are the different economic system?  | 2.00 |
| (b) What are the features of capitalist economic system? Discuss its advantages and disadvantages.  | 6.75 |
| 2. (a) Explain demand and supply in economics. What are laws of demand and supply?  | 2.75 |
| (b) What is equilibrium in the market? Explain with necessary figures.  | 4.00 |
| (c) Consider a commodity $Q_{d1} = 18 - 3p$ and $Q_{s1} = -3 + 4p$ , where $Q_{d1}$ , $Q_{s1}$ and $p$ denotes quantity demanded, quantity supply and price respectively. Find the equilibrium price and quantity for that commodity. | 2.00 |
| 3. (a) Define production function.  | 2.25 |
| (b) Discuss all the factors of production in brief.   | 3.00 |
| (c) Write the characteristics of a perfectly competitive market.  | 3.50 |

### Section-B

- |  |      |
|--|------|
| 4. (a) What is unemployment? Explain the different types of unemployment in brief.           | 5.25 |
| (b) Explain the nature of unemployment in under-developed countries.                         | 3.50 |
| 5. (a) What is inflation? Explain the demand-pull and cost-push inflation with example.      | 3.50 |
| (b) Discuss in brief the causes of inflation.  | 5.25 |
| 6. (a) What is government budget?  | 2.00 |
| (b) Distinguish between revenue and capital budget.  | 3.00 |
| (c) What are the major sources of revenue and heads of expenditure of Bangladesh government? | 3.75 |

**University of Rajshahi**  
**Department of Computer Science of Engineering**

B. Sc. (Engg.) Part-I, Even Semester Exam - 2017

Course Title: ECON-1211 (Economics)

Total marks: 35

Time: 2 Hours

[Answer two questions from each section]

**Section-A**

- |    |  |      |
|----|--|------|
| 1. | a) Define Economics with criticism. Discuss the subject matter of Economics.   | 3    |
|    | b) What are the central economic problems of every society? Discuss.   | 2.25 |
|    | c) Explain the fundamental characteristics of different economics systems.   | 3.5  |
| 2. | a) Distinguish between demand schedule and demand curve. Draw a demand curve from a hypothetical demand schedule.              | 3    |
|    | b) What is meant by shift in demand and supply curves? Mention the factors that cause shifts in demand and supply curves.      | 2.75 |
|    | c) Define elasticity of demand. Write down the formulae for computing price, income and cross elasticities of demand.          | 3    |
| 3. | a) What is meant by production? Discuss the factors of production.   | 3    |
|    | b) What is meant by cost of production? Distinguish between fixed costs and variable costs with the help of necessary figures. | 3    |
|    | c) What is a market in Economics? Discuss the characteristics of perfectly competitive market.                                 | 2.75 |

**Section-B**

- |    |  |      |
|----|--|------|
| 4. | a) What does economic growth mean?   | 2    |
|    | b) Explain the difference between economic growth and economic development.                | 4    |
|    | c) Explain the circular flow of income in an economy.                                      | 2.75 |
| 5. | a) Describe the different methods of national income accounting.                           | 5.75 |
|    | b) Discuss the problems of national Income accounting in Bangladesh.                       | 3    |
| 6. | a) What is meant by budget? How is a deficit budget financed?                              | 3    |
|    | b) Critically examine the development philosophy of the planning commission of Bangladesh. | 3    |
|    | c) Explain the major objectives of the 7 <sup>th</sup> Five Year Plan of Bangladesh.       | 2.75 |

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B.Sc.(Engg.), Part-I, Even Semester Examination-2017**  
**Course: CSE1211 (Introduction to Digital Electronics)**  
**Time: 3 Hrs.**      **Full Marks: 52.5**  
**[N.B. Answer any Three questions from each Section.]**

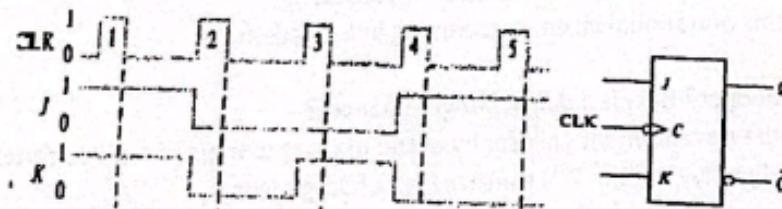
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**Section A**

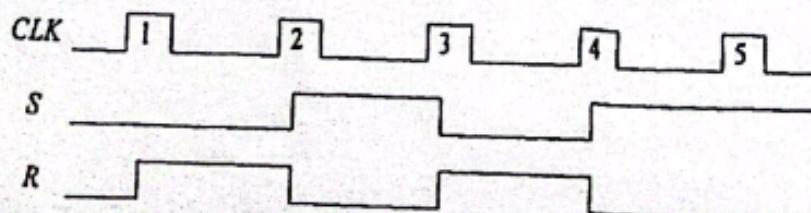
1. (a) Convert  $(FBA.BC)_{16}$  to decimal and  $(486.524)_{10}$  to binary. 3
- (b) Convert  $(465.32)_8$  to decimal and  $(11010101.1101)_2$  to Decimal. 3
- (c) Write the Excess-3 code for  $(53)_{10}$ . Attach an even parity bit with the generated code. 2.75
  
2. (a) Perform the following operations of the signed binary numbers using 2's complement method: 3
  - (i)  $00001100 - 11110111$  (ii)  $10001000 - 11100010$
- (b) Show that both NAND gate and NOR gate can be used as universal gate. 3
- (c) Multiply the signed binary numbers: 01010011 (multiplicand) and 11000101 (multiplier). 2.75
  
3. (a) Explain half adder and full adder in detail with circuit diagram and truth table. 6
- (b) What is DeMorgan's theorem? Explain with truth table. 2.75
  
4. (a) Explain the formation of AND, OR and NOT gate using NAND gate only. 2.75
- (b) Simplify the following Boolean function using K-map and realize with basic gates: 6
 
$$F = (A, B, C, D) = \sum m(0, 1, 3, 5, 7, 8, 9, 13) + \sum d(10, 11, 15)$$

**Section B**

5. (a) What are the functions of transducer and actuator? 2
- (b) Describe the basic operation of the digital-ramp ADC. 3.75
- (c) A 5-bit DAC produces  $V_{out} = 0.2 V$  for a digital input of 00001. Find the value of  $V_{out}$  for an input of 11111. What would be the resolution? Describe the staircase signal out. 3
  
- 6(a) Draw a circuit diagram of a D latch and explain its operation. 4
- (b) The waveforms in Figure are applied to the J, K, and clock inputs as indicated. Determine the Q output, assuming that the flip-flop is initially RESET. Also explain about the states of the Q output according to the waveforms. 4.75



- 7.(a) Draw the CMOS NAND gate circuit and explain its operation. 3
- (b) Draw the TTL NOR gate circuit and explain its operation. 4
- (c) Define the terms: (i) Fan-Out (ii) Propagation Delay and (c) Noise Immunity. 1.75
  
8. (a) Draw the internal functional diagram of a 555 timer and explain the basic operation. 3.75
- (b) For a certain astable multivibrator  $t_H = 15$  ms and  $T = 20$  ms. What is the duty cycle of the output? 2
- (c) Determine the waveforms for both outputs of a positive edge triggered S-R flip-flop for the following S, R and CLK input. Assume that the flip-flop is initially RESET. 3



---

**Part A**

1. (a) Define economics. What are the fundamental problems of any economy? 4  
 (b) Discuss the subject matters of microeconomics and macroeconomics. 2  
 (c) Explain the relation between economics and engineering 2.75
  
2. a) State the law of demand. Draw a demand curve using the demand equation  $Q_d = 50 - 5p$  3.  
 b) What is supply? What are the causes of change in supply? Explain. 2  
 c) Using the following demand and supply equations, find the equilibrium quantity and market price:  $Q_d = 20 - 2p$ ,  $Q_s = 10 + 3p$  3.75
  
3. a) What is production? Discuss the four factors of production. 3  
 b) Define cost. Distinguish between fixed cost and variable cost. 3  
 c) What is a market? Discuss the main differences between perfect competition and monopoly. 2.75

---

**Part B**

4. (a) Define inflation and unemployment. 2  
 (b) How are inflation and unemployment related in the short-run? Explain this relationship with the help of Philips curve. 3  
 (c) What is business cycle? Discuss the phases of business cycle. 3.75
  
5. (a) What is national income? Distinguish between Gross Domestic Product (GDP) and Gross National Product (GNP). 3  
 (b) What do you mean by multiplier? Prove that the investment multiplier is  $\frac{\Delta Y}{\Delta I} = \frac{1}{1-MPC}$  3.75  
 (c) Suppose, the level of autonomous investment ( $I$ ) in any economy is Tk. 200 crores and consumption function of the economy is  $C = 80 + 0.75Y$ .  
     (i) What will be the equilibrium level of income?  
     (ii) What will be the increase in national income if the investment increases by Tk. 25 crores? 2
  
6. (a) What do you mean by budget? Distinguish between revenue budget and capital budget. 3  
 (b) What are the major sources of revenue of the government of Bangladesh? Discuss. 3  
 (c) Explain the major objectives of the first five years plan of Bangladesh. 2.75

**University of Rajshahi**  
**Department Of Computer Science and Engineering**  
**B.Sc.(Engg.) Part-I, Even Semester Examination-2014**  
**Course: ECON 1211 (Economics)**  
**Full Mark: 35 Duration: 2 hours**

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**[N.B. Answer any four questions taking two from each group. Figures in the right margin indicate full marks]**

**Part-A**

1. a) What do you mean by economics? Explain the concepts of total product, 3  
average product and marginal product in economics.
- b) Mention the three stages of production. Explain why a rational producer 5.75  
concentrates producing on the second stage of the total product curve.
2. a) Discuss what are meant by price elasticity, cross price elasticity and income 3  
elasticity of demand.
- b) If the demand for the commodity y increases from 5 units to 8 units as a result 2  
of increase in income of a consumer from Tk. 50,000.00 to Tk. 65,000.00, find  
the income elasticity of demand and comment on the nature of the commodity.
- c) Show that the price elasticity of demand ranges from zero to infinity. 3.75
3. a) What is meant by a perfectly competitive market? State its assumptions. 3
- b) Explain the conditions for obtaining equilibrium of a firm under a perfect 5.75  
competition.

**Part-B**

4. a) Distinguish between GDP and GNP. 3
- b) Graphically explain the circular flow of national income in a simple two sector 3.75  
economy.
- c) Discuss various steps of business cycle. 2
5. a) What is inflation? 2
- b) What are the features and causes of inflation? 3.75
- c) Compare among the methods of measuring national income. 3
6. a) What is meant by multiplier? 2
- b) Describe the simple Keynesian model for the determination of national income 4  
with the help of expenditure method.
- c) What are the differences between revenue budget and capital budget? 2.75

Answer all five (05) questions

- Add a method to the Table class below that computes the average of the neighbors of a table element in the eight directions shown in Figure (*Neighboring Locations in a Two-Dimensional Array*)

```
public double neighborAverage(int row, int column)
```

However, if the element is located at the boundary of the array, include only the neighbors that are in the table. For example, if row and column are both 0, there are only three neighbors.

$[i - 1][j - 1]$     $[i - 1][j]$     $[i - 1][j + 1]$

$[i][j - 1]$     $[i][j]$     $[i][j + 1]$

$[i + 1][j - 1]$     $[i + 1][j]$     $[i + 1][j + 1]$

```
public class Table{
    private int[][] values;
    public Table(int rows, int columns) {
        values = new int[rows][columns];
    }
    public void set(int i, int j, int n) {
        values[i][j] = n;
    }
}
```

- Declare a class ComboLock that works like the combination lock in a gym locker, as shown here. The lock is constructed with a combination of three numbers between 0 and 39. The reset method resets the dial so that it points to 0. The turnLeft and turnRight methods turn the dial by a given number of ticks to the left or right. The open method attempts to open the lock. The lock opens if the user first turns it right to the first number in the combination, then left to the second, and then right to the third.

```
public class ComboLock{
    ...
    public ComboLock(int secret1, int secret2, int secret3) { . . . }
    public void reset() { . . . }
    public void turnLeft(int ticks) { . . . }
    public void turnRight(int ticks) { . . . }
    public boolean open() { . . . }
}
```



3. Consider an interface

```
public interface NumberFormatter{  
    String format(int n);  
}
```

Provide four classes that implement this interface. A DefaultFormatter formats an integer in the usual way. A DecimalSeparatorFormatter formats an integer with decimal separators; for example, one million as 1,000,000. An AccountingFormatter formats negative numbers with parentheses; for example, -1 as (1). A BaseFormatter formats the number in base n, where n is any number between 2 and 36 that is provided in the constructor.

4. Write a program that reads a file containing text. Read each line and send it to the output file, preceded by line numbers. If the input file is

```
Mary had a little lamb  
Whose fleece was white as snow.  
And everywhere that Mary went,  
The lamb was sure to go!
```

Then the program produces the output file

```
/*1*/ Mary had a little lamb  
/*2*/ Whose fleece was white as snow.  
/*3*/ And everywhere that Mary went,  
/*4*/ The lamb was sure to go!
```

The line numbers are enclosed in /\* \*/ delimiters so that the program can be used for numbering Java source files. Prompt the user for the input and output file names.

5. Write a program **Find** that searches all files specified on the command line and prints out all lines containing a reserved word. Start a new thread for each file. For example, if you call

```
java Find Buff report.txt address.txt Homework.java
```

Then the program might print

```
report.txt: Buffet style lunch will be available at the  
address.txt: Buffet, Warren|11801 Trenton Court|Dallas|TX  
Homework.java: BufferedReader in;  
address.txt: Walters, Winnie|59 Timothy Circle|Buffalo|MI
```

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
 B. Sc. (Engg.) Part-1, Even Semester Examination 2019  
 Course: CSE-1221 (Object Oriented Programming)  
 Marks: 52.5 Duration: 3 hours  
(Answer 3 questions from each part)

**Part -A**

- |       |  |      |
|-------|--|------|
| 1. a) | What are the similarities and differences between Java and C++?  | 2.5  |
| b)    | What is the role of Java Virtual machine?  | 2.5  |
| c)    | In the following code snippet, explain what each of the keywords is used for.<br><code>public static void main (String []args ) throws IOException {<br/>    // code inside main method<br/>}</code> | 3.75 |
| 2. a) | In the following Java code Identify as many of the mistakes as you can. Explain whether each mistake you identify will cause compilation error, runtime error or logical error.                      | 7    |

```

1 public Class mycode.java
2 {
3     void static public fun main(String [args])
4     begin
5         Leaf tr = null;
6         for (i=1; i>10; ++i)
7             tr = new Node(i, tr)
8             tr.print();
9     end;
10 }
11
12 class Leaf {
13     integer value;
14
15     Leaf(int value){ this = value; }
16
17     public void print(){ System.out.println(value); }
18 }
19
20 class Node extends Leaf {
21     Leaf left, right;
22
23     Node(leaf l, Leaf r) { left = l, right = r; }
24
25     void print(){
26         left.print();
27         System.out.println("val=" & value);
28         right.print();
29     }
30 }

```

- |       |   |      |
|-------|---|------|
| b)    | Distinguish between overloading and overriding with examples in Java code..   | 1.75 |
| 3. a) | What are the differences and similarities between abstract class and interface? Mention a situation when the use of one of them is preferable over the other. | 3.5  |
| b)    | See the program below. Identify and explain the problems in the code. After fixing the problem, what will be the output?                                      | 3    |

```

1 class Base {
2     final public void Print() {
3         System.out.println("Base");
4     }
5 }
6
7 class Derived extends Base {
8     public void Print() {
9         System.out.println("Derived");
10    }
11 }
12
13 class Main{
14     public static void DoPrint( Base o ) {
15         o.Print();
16     }
17     public static void main(String[] args) {
18         Base x = new Base();
19         Base y = new Derived();
20         Derived z = new Derived();
21         DoPrint(x);
22         DoPrint(y);
23         DoPrint(z);
24     }
25 }

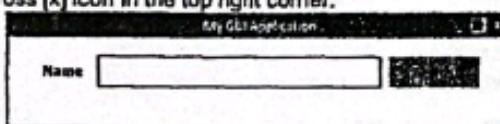
```

2.25

- c) What are the purposes of super keyword in Java? 2.75
4. a) What do you understand by object-oriented design pattern? Why should we use them? 3
- b) Suppose that your program has a class that you want to have only one instance created and this instance must be reused during the lifetime of your program. Which design pattern will you use to implement that. Explain with example. 3
- c) Briefly discuss the idea of Observer pattern with example.

### Part -B

5. a) Explain exception handling mechanism in Java. 3
- b) When is throws keyword is used in Java? 1.5
- c) Explain the hierarchy of exceptions in Java? 3
- d) What are checked and unchecked exceptions in Java? 1.25
6. a) What is thread? Describe the life cycle of a thread. 4
- b) How do you ensure that n threads can access n resources without deadlock? 2
- c) What is "Instance Variable Hiding" problem? How can this problem be solved? 2.75
7. a) What are the functions of Event object, event source and event listener in delegate event model? Explain with diagram. 3
- b) what are the advantages of swing over AWT? 2
- c) Write an AWT based application that uses FlowLayout manager to layout the following UI that can be closed by clicking cross [x] icon in the top right corner. 3.75



8. a) In a large project it is possible that two programmers, working on different parts of the code, happen to select the same name for a class that they define. If this accident leads to some third programmer accessing the wrong one of these two classes, the results could be unsatisfactory. Explain the steps that the designers of the Java language have taken to reduce the probability of such incident. 2
- b) Explain what problem can arise while using the following generic class. How to fix it? 3

```

1 class Stats<T> {
2     T[] nums;
3
4     Stats(T[] o) {
5         nums = o;
6     }
7
8     double sum() {
9         double x = 0.0;
10        for(int i=0; i < nums.length; i++)
11            x += nums[i].doubleValue();
12
13        return x;
14    }
15 }
```

- c) Write a Java program that reads the content of a file and writes the content back to another file. 3.75

University of Rajshahi  
 Dept. Of Computer Science and Engineering  
 B. Sc. Engg. Part 1 Even Semester Examination 2019  
 Course: CSE 1221 (Object Oriented Programming) (for the session 2016-2017)  
 Full Mark: 52.5 Duration: 3 hours  
Answer 6 questions taking at least 3 from each part

**Part -A**

- |       |  |      |
|-------|--|------|
| 1. a) | What is Object Oriented Programming? Give a brief description of polymorphism, encapsulation and inheritance?            | 3.75 |
| b)    | What are the differences between C and C++?  | 3    |
| c)    | What is the use of 'protected' access specifier?   | 2    |
| 2. a) | What are the problems with the following code segment?<br><br>int *I, *j;<br>j=I*2;<br>cout>>j;                          | 2    |
| b)    | What are the purposes of constructor and destructor function? Can these functions have input parameters and return type? | 2.75 |
| c)    | What is an inline function? With example explain the different ways to declare a function as inline.                     | 2.5  |
| d)    | Is there any way for a non-member function to access private members of a class? Explain.                                | 1.5  |
| 3. a) | How between new and delete is different from malloc() and free()?  | 3    |
| b)    | What are the advantages of using reference over pointer? What are the restrictions of using reference?                   | 3.75 |
| c)    | Is the following fragment valid? If not, then why?<br><br>int &f();<br>:<br>int *x();<br>x=f();                          | 2    |
| 4. a) | Why copy constructor is used? Explain with example   | 3.75 |
| b)    | What is wrong with the following function prototype?<br><br>char * f(char *p, int x=0, char *q)                          | 2    |
| c)    | Explain how ambiguity can arise while overloading functions.   | 3    |

**Part -B**

- |       |  |      |
|-------|--|------|
| 5. a) | What do you mean by operator overloading? What are the restrictions applied to operator overloading? | 2.75 |
| b)    | What are the advantages of overloading an operator using friend function?                            | 3    |
| c)    | Explain why protected access specifier is used while inheriting a base class?                        | 2    |
| d)    | In derived class, in which order constructors and distractors are called?                            | 1    |
| 6. a) | What is multi-level inheritance? Describe a scenario in which multi-level inheritance can cause      | 2.5  |

- ambiguity.
- b) How the ambiguity mention above can be solved? 1.25
- c) Write a short program that will use C++ I/O to copy content of a text file and write that content into another file. 3
- d) What is an abstract class? Can we create instances of an abstract class? 2
7. a) Distinguish between runtime and compile time polymorphism? How runtime polymorphism is achieved? 3.75
- b) What is the difference between virtual function and overloaded function? 2
- c) What is a pure virtual function? How a pure virtual function is declared? 1
- d) Define early binding and late binding with example. 2
8. a) What is exception handing? Explain various types of exception handing 3
- b) What is the difference between expectation and errors? 1
- c) What is Standard Template Library? 2
- d) How can you rethrow an exception? Explain with example. 2.75

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B. Sc. (Engg.) Part-1, Even Semester Examination 2018**  
**Course: CSE-1221 (Object Oriented Programming)**  
**Marks: 52.5 Duration: 3 hours**

(Answer 3 questions from each part)

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**Part-A**

1. a) Why java is called "the language of the Internet"? Explain. 2  
b) Compare Java with C programming language. 2  
c) Consider the following java program: 4.75

```
public interface IRunnable {  
    public void run();  
}  
  
Class JavaApp extends ClassA, ClassB implements IRunnable  
{  
    void main(String args) {  
        System.in.println("This is a Java program.");  
    }  
}
```

Point out the mistakes. Also, correct the program so that it can be compiled.

2. a) What is singleton class? 1.5  
b) What is Final keyword in Java? Give an example. 2.25  
c) Write a program in Java which take 10 numbers, store it in a combo box and 3  
display the largest one.  
d) What happens if an exception is not caught? 2
3. a) You are writing a program which can draw various 2D shapes like circle, 4.5  
rectangle, triangle and 3D shapes like cube and spheres of with different colors  
and calculate the area and volume of the shapes.

With class diagram explain how you will achieve the task in an object-oriented  
manner?

- b) Briefly describe the Object class in java. 2.25  
c) What are the conditions for a class to become abstract? Can you declare an 2  
object of abstract class?

- |    |  |      |
|----|--|------|
| 4. | a) Discuss how try-catch-finally block works in java.                            | 3    |
|    | b) How can you define your own exception type in java?                           | 2.5  |
|    | c) What are the difference between InputStream class and Reader class?           | 1    |
|    | d) Write a simple java program to copy content of a text file into another file. | 2.25 |

### Part -B

- |    |   |      |
|----|---|------|
| 5  | a) What is thread? Discuss java thread model.   | 3.25 |
|    | b) Write a program to demonstrate the creation and execution of threads. How can you ensure all threads that started from main must end in order in which they started and main should end in last? | 2.5  |
|    | c) What is "Instance Variable Hiding" problem? How this problem can be resolved?  | 3    |
| 6. | a) With suitable block diagram explain Delegation Event Model in java.  | 3    |
|    | b) Why is swing preferable for GUI programming over AWT?  | 2    |
|    | c) What are the purpose of event Adapter classes?   | 1    |
|    | d) Describe shortly how to achieve the following GUI layout. (Which layouts are used, how they are nested?)   | 2.75 |



- |    |   |      |
|----|---|------|
| 7. | a) What is Dynamic binding? Show with an example how dynamic binding works.   | 2    |
|    | b) What are Java packages? What is the significance of packages?  | 3    |
|    | c) Design a Java package for numbers. Develop two different classes that belongs to two package, one for to check whether the given number is palindrome or not and the other to check whether the given number is odd or even and access these package using one main file | 3.75 |
| 8. | a) What do you mean by "design pattern" in OOP? How are they useful?  | 2    |
|    | b) With appropriate example and class diagram explain the Abstract Factory Design Pattern.  | 5    |
|    | c) Which design pattern will you use to make sure only one instance of an object is created and reused during the execution cycle of a java program? Explain.   | 1.75 |

University of Rajshahi  
Department of Computer Science and Engineering  
B. Sc. Engg. Part1 Even Semester, Examination-2018 (Session 2016-17)  
Course: CSE-1221 (Object Oriented Programming with C++)

Time: 3 Hours

Full Marks: 52.5

[Answer any six questions taking three from each Section]

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**SECTION A**

- 
- |  |      |
|--|------|
| 1. a) Briefly describe the key features in object oriented programming language?   | 3.75 |
| b) Shortly describe the purpose of C++ namespace.  | 3    |
| c) Define C++ class and objects.   | 2    |
|  |      |
| 2. a) How can you define the access rights for the members of a class? Write a simple C++ program using various access specifiers. | 3.75 |
| b) What are the purposes of constructor and destructor functions?  | 3    |
| c) What is copy constructor in C++?  | 2    |
|  |      |
| 3. a) How can you give permission to a nonmember function access to the private members of a class?                                | 4.75 |
| b) Write down the usefulness of friend function.   | 2    |
| c) How can you open and close a file in C++ program by using different types of streams?   | 2    |
|  |      |
| 4. a) Write a fragment of program that overload member operator function (+).  | 3    |
| b) How can you create prefix and postfix forms of the increment and decrement operators?   | 3    |
| c) Friend operator functions add flexibility. Discuss with example.  | 2.75 |

## SECTION B

5. a) Define base class and derived class. Do base class and derived class have any specific purpose in C++ programming language to achieve any key feature in Object Oriented Programming? Explain with C++ code. 5.75

- b) Are the protected members of a base class accessible by a derived class when the base class is inherited as public? 3

6. a) Write the output of the following C++ program. 4

```
#include <iostream>
using namespace std;
class base {
public:
    base() { cout << "Constructing base\n"; }
    ~base() { cout << "Destructing base \n"; }
};
class derived: public base {
public:
    derived() { cout << "Constructing derived\n"; }
    ~derived() { cout << "Destructing derived\n"; }
};
int main() {
    derived ob;
    return 0;
}
```

- b) What is the purpose of using virtual base class? 2.75

- c) What is exception handling? 2

7. a) How can we create initialized and uninitialized array of objects by overloading constructor function? Give example with C++ code. 4.75

- b) Explain the use of pointer in C++. What do you mean by 'this' pointer? 4

8. a) What is generic function? Write the general form of a template function definition. 2

- b) Can you mix standard parameters with generic type parameters in a template function? Explain. 3

- c) Write the use of width(), precision() and fill() member functions with example. 3.75

---

**Part A**

1. (a) Write some features of OOP. 2  
 (b) Differentiate between structure and class with an example. 1.75  
 (c) What is local class? What are the restrictions of local classes? Discuss with example. 3  
 (d) Is it possible to return an object from a function? If possible, how? 2
  
2. a) Is it possible to have arrays of objects? If possible, how? 2  
 b) What is 'this pointer'? Explain. 2  
 c) Define inline function. Discuss about the restrictions with inline function. 3  
 d) How can you allocate objects dynamically? 1.75
  
3. a) What is constructor overloading? What are the reasons to overload a constructor? 2.75  
 b) Why overloading sometimes causes ambiguity? Describe with example. 3  
 c) What is default argument? What are the advantages of default arguments? Give example. 3
  
4. a) Explain different types of inheritance with block diagram and examples. 3.5  
 b) What is the ambiguity that arises in multiple inheritance? How it can be overcome? Explain with example. 2.5  
 c) Discuss the implications of deriving a class from an existing class by the 'public' and 'protected' access specifiers with examples. 2.75

---

**Part B**

5. (a) Why is constructor functions executed in order of derivation? 1  
 (b) How do you pass arguments to a constructor in a base class? Discuss with example. 4  
 (c) Briefly discuss virtual base class with an example. 3.75
  
6. (a) 'The virtual attribute is inherited'- explain it with an example. 2.75  
 (b) What is a pure virtual function? Discuss it with an example. 3  
 (c) Differentiate between early binding and late binding. 3
  
7. (a) How can you define more than one generic data type in the template function? Explain with an example. 2  
 (b) Can you mix standard parameters with generic type parameters in a template function? Explain. 2  
 (c) Is it possible to catch a class type? Explain. 2.75  
 (d) How can you restrict the type of exceptions that a function can throw outside of itself? 2
  
8. (a) List and explain in brief the various functions required for random access file operations. 3.5  
 (b) How do 'endl' and 'setw' manipulators work? Illustrate with example. 2.5  
 (c) What is the difference between opening a file with constructor function and opening a file with 'open()' function? 2.75

Part-A

1. a) What is object-oriented programming? How are data and functions organized in an object-oriented program? 3
- b) What kind of things can become an object in OOP? 1.75
- c) Distinguish between the following terms:  
        i) Inheritance and polymorphism 3
- ii) Objects and classes
- d) What is meant by data binding? 1
  
2. a) How we can run our C++ program without header files? 3
- b) Describe the major parts of a C++ program. 2
- c) How can you create an initialized array of objects? 2
- d) What is new and delete? What are their advantages? 2
  
3. a) Briefly discuss copy constructor with an example. 4
- b) Write some ambiguities of function overloading. 2.75
- c) What is a constructor? What is wrong with the constructor shown in the following fragment?  

```
class sample {
    double a, b, c;
public:
    double sample();
};
```

 2
  
4. a) How does binary operator operate? Give an example. 3
- b) How can you create prefix and postfix forms of the increment and decrement operators? 2.75
- c) Write a fragment of program that overloads friend operator function (-). 3

Part-B

5. a) What are the different forms of inheritance? Give an example of each. 4.75
- b) In what order are the class constructors called when a derived class object is created? 2
- c) Consider the following code:  

```
class B {};
class D1 : public B {};
class D2 : public B {};
class DD : public D1, public D2 {};
```

 2
- How can you prevent the creation of two copies of base class B in a DD object?
  
6. a) How is polymorphism achieved at (a) compile time and (b) run time? 2
- b) When do we make a virtual function "pure"? What are the implications of making a function a pure virtual function? 3
- c) How could we specify the types of objects a function can throw? 2
- d) When should a function throw an exception? 1.75

7. a) What is exception handling? Write the general form of exception handling. 3  
b) Is it possible to write a try block inside a function? Explain. 2  
c) Write the use of width(), precision() and fill() member functions with example. 3.75
8. a) How can you read from and write to a text file? Discuss. 3  
b) Briefly discuss getline() function with example. 2  
c) Shortly discuss random access from a file with example. 3.75

==@==

Section- A

- 1.(a) Which of the following are legal identifiers in Java? 1.75  
 (i)g (ii)void (iii)101dalmatians (iv)Hello, World (v)<greeting>
- (b) What does this sequence of statements print? 1.50  
 Rectangle box = new Rectangle(5, 10, 20, 30);  
 System.out.println("Before: " + box.getWidth());  
 box.translate(25, 40);  
 System.out.println("After: " + box.getWidth());
- (c) What is encapsulation? Why is it useful? 2.00
- (d) Consider the following implementation of a class Square : 2.00  
 public class Square{  
 private int sideLength;  
 private int area; // Not a good idea  
 public Square(int length){  
 sideLength = length;  
 }  
 public int getArea(){  
 area = sideLength \* sideLength;  
 return area;  
 }  
}
- Why is it not a good idea to introduce an instance variable for the area? Rewrite the class so that area is a local variable.
- (e) Write the difference between equals() method and equality operator (==) in Java. 1.50

- 2.(a) What is vector? How is it different from an array? 2.75
- (b) How does String class differ from the StringBuffer class? Explain with example. 3
- (c) Write a method called  
 delete (String str, int m)  
 that returns the input string with the m<sup>th</sup> element removed. 3
- 3.(a) What do these loops print by given the variables 2.00  
 String stars = "\*\*\*\*\*";  
 String stripes = "=====";  
  
 (i) int i = 0;  
 while (i < 5){  
 System.out.print(stars.substring(0, i));  
 System.out.println(stripes.substring(i, 5));  
 i++;  
 }

```

(ii) int i = 0;
while (i < 10) {
    if (i % 2 == 0)
        System.out.println(stars);
    else
        System.out.println(stripes);
}

```

1.75

(b) The nested loops

```

for (int i = 1; i <= height; i++) {
    for (int j = 1; j <= width; j++) {
        System.out.print("*");
    }
    System.out.println();
}

```

Display a rectangle for a given width and height, such as (width=4, height=3)

\*\*\*\*  
\*\*\*\*  
\*\*\*\*

Yrpa!s

Write a single for loop that displays the same rectangle.

- + (c) Consider the following loop for collecting all elements that match a condition; in this case, that the element is larger than 100. 2.00

```

ArrayList<Double> matches = new ArrayList<Double>();
for (double element : values)
    if (element > 10)
        matches.add(element);

```

Trace the flow of the loop, where values contain the elements 10 9 10 12 8. Show two columns, for element and matches.

- (d) How do you perform the following tasks with array lists in Java? 3.00

- (i) Test that two array lists contain the same elements in the same order.
- (ii) Copy one array list to another.
- (iii) Fill an array list with zeros, over writing all elements in it.

- 4.(a) Why is it a good idea to minimize dependencies between classes? 1.75

- (b) You need to write a program for DNA (Contain A, T, C & G) sequence analysis that checks whether a substring of one string is contained in another string. What simpler problem can you solve first? 2.00

- (c) Give a rule of thumb for how to find classes and methods when designing a program. 2.00

- (d) After discovering a method, why is it important to identify the object that is responsible for carrying out the action? 1.00

- (e) Every BMW is a vehicle. Should a class BMW inherit from the class Vehicle ? BMW is a vehicle manufacturer. Does this mean that the class BMW should inherit from the class VehicleManufacturer? 2.00

Section-B

3.00

- 5.(a) Suppose the class Employee is declared as follows:

```
public class Employee{  
    private String name;  
    private double baseSalary;  
  
    public void setName(String newName) { . . . }  
    public void setBaseSalary(double newSalary) { . . . }  
    public String getName() { . . . }  
    public double getSalary() { . . . }  
}
```

Declare a class Manager that inherits from the class Employee and adds an instance variable bonus for storing a salary bonus. Omit constructors and methods.

- (b) Will the following code fragment compile? Will it run? If not, what error is reported?

```
Object obj = "Hello";  
System.out.println(obj.length());
```

1.7:

- (c) What does this code fragment print? Why is this an example of polymorphism?

```
Measurable[] data =  
{ new BankAccount(10000), new Country("Belgium", 30510) };
```

System.out.println(average(data));  
Assume that the class BankAccount, Country and the interface Measurable has a proper definition.

2.00

- (d) Suppose the class Sandwich implements the Edible interface, and you are given the variable declarations

```
Sandwich sub = new Sandwich();  
Rectangle cerealBox = new Rectangle(5, 10, 20, 30);  
Edible e = null;
```

2.00

Which of the following assignment statements are legal?

- i. e = sub;
- ii. sub = e;
- iii. sub = (Sandwich) e;
- iv. sub = (Sandwich) cerealBox;
- v. e = cerealBox;
- vi. e = (Edible) cerealBox;
- vii. e = (Rectangle) cerealBox;
- viii. e = (Rectangle) null;

3.00

- 6.(a) What is wrong with the following code, and how can you fix it?

1. public static void writeAll(String[] lines, String filename){
2. PrintWriter out = new PrintWriter(filename);
3. for (String line : lines){
4. out.println(line.toUpperCase());
5. }
6. out.close();
7. }

- (b) The following code tries to close the writer without using a try-with-resources statement:
- ```
PrintWriter out = new PrintWriter(filename);
try{
    //Write output.
    out.close();
} catch (IOException exception){
    out.close();
}
```
- What is the disadvantage of this approach?

1.75

- (c) Suppose the input contains the characters 995.0 Fred. What are the values of number and input

```
Scanner in = new Scanner(System.in);
int number = 0;
if (in.hasNextInt()) {
    number = in.nextInt();
}
String input = in.next();
```

1.75

- (d) How do you move the file pointer to the first byte of a file? To the last byte? To the exact middle of the file? 2.00

- 7.(a) Show two different ways of converting String object into Integer in Java. 1

- (b) An n-digit number that is the sum of the n-th powers of its digits is called an Armstrong Number. 4.75  
For example, 153 and 370 are Armstrong numbers, since  $153 = 1^3 + 5^3 + 3^3$  and  $370 = 3^3 + 7^3 + 0^3$ . But 15 and 37 are not Armstrong numbers, since  $15 \neq 1^2 + 5^2$  and  $37 \neq 3^2 + 7^2$ . First few Armstrong numbers are 1, 2, 3, 4, 5, 6, 7, 8, 9, 153, 370, 371, 407, 1634 and so on. Write a Java program to find whether the given number is Armstrong or not.

- (c) Why is an Interface used in Java? How is an Interface declared and used? 3

3

- 8.(a) Consider the following runnable. 3.00

```
public class MyRunnable implements Runnable{
    public void run(){
        try{
            System.out.println(1);
            Thread.sleep(500);
            System.out.println(2);
        } catch (InterruptedException exception){
            System.out.println(3);
        }
        System.out.println(4);
    }
}
```

Suppose a thread with this runnable is started and immediately interrupted:

```
Thread t = new Thread(new MyRunnable());
t.start();
t.interrupt();
```

What output is produced?

- (b) What are the two ways of implementing thread in Java? Provide necessary coding examples. 4.00
- (c) How do threads communicate with each other? 1.75

```

(ii) int i = 0;
while (i < 10){
    if (i % 2 == 0)
        System.out.println(stars);
    else
        System.out.println(stripes);
}

```

1.75

(b) The nested loops

```

for (int i = 1; i <= height; i++) {
    for (int j = 1; j <= width; j++) {
        System.out.print("**");
    }
    System.out.println();
}

```

Display a rectangle for a given width and height, such as (width=4, height=3)

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Write a single for loop that displays the same rectangle.

(c) Consider the following loop for collecting all elements that match a condition; in this case, that the element is larger than 100. 2.00

```

ArrayList<Double> matches = new ArrayList<Double>();
for (double element : values)
    if (element > 10)
        matches.add(element);

```

Trace the flow of the loop, where values contain the elements 10 9 10 12 8. Show two columns, for element and matches.

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(c) Give a rule of thumb for how to find classes and methods when designing a program. 2.00

(d) After discovering a method, why is it important to identify the object that is responsible for carrying out the action? 1.00

(e) Every BMW is a vehicle. Should a class BMW inherit from the class Vehicle ? BMW is a vehicle manufacturer. Does this mean that the class BMW should inherit from the class VehicleManufacturer? 2.00

### Section-B

- 5.(a) Suppose the class Employee is declared as follows: 3.00
- ```
public class Employee{  
    private String name;  
    private double baseSalary;  
  
    public void setName(String newName) { . . . }  
    public void setBaseSalary(double newSalary) { . . . }  
    public String getName() { . . . }  
    public double getSalary() { . . . }  
}
```
- Declare a class Manager that inherits from the class Employee and adds an instance variable bonus for storing a salary bonus. Omit constructors and methods.
- (b) Will the following code fragment compile? Will it run? If not, what error is reported? 1.75
- ```
Object obj = "Hello";  
System.out.println(obj.length());
```
- (c) What does this code fragment print? Why is this an example of polymorphism? 2.00
- ```
Measurable[] data =  
{ new BankAccount(10000), new Country("Belgium", 30510) };  
System.out.println(average(data));
```
- Assume that the class BankAccount, Country and the interface Measurable have a proper definition.
- (d) Suppose the class Sandwich implements the Edible interface, and you are given the variable declarations 2.00
- ```
Sandwich sub = new Sandwich();  
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  - iii. sub = (Sandwich) e;
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  - v. e = cerealBox;
  - vi. e = (Edible) cerealBox;
  - vii. e = (Rectangle) cerealBox;
  - viii. e = (Rectangle) null;
- 6.(a) What is wrong with the following code, and how can you fix it? 3.00
1. public static void writeAll(String[] lines, String filename){
  2. PrintWriter out = new PrintWriter(filename);
  3. for (String line : lines){
  4. out.println(line.toUpperCase());
  5. }
  6. out.close();
  7. }

- (b) The following code tries to close the writer without using a try-with-resources statement: 2.00
- ```

PrintWriter out = new PrintWriter(filename);
try{
    //Write output.
    out.close();
} catch (IOException exception){
    out.close();
}

```
- What is the disadvantage of this approach?
- (c) Suppose the input contains the characters 995.0 Fred. What are the values of number and input after this code fragment? 1.75
- ```

Scanner in = new Scanner(System.in);
int number = 0;
if (in.hasNextInt()) {
    number = in.nextInt();
}
String input = in.next();

```
- (d) How do you move the file pointer to the first byte of a file? To the last byte? To the exact middle of the file? 2.00
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- (c) Why is an Interface used in Java? How is an Interface declared and used? 3
- 8.(a) Consider the following runnable. 3.00
- ```

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    public void run(){
        try{
            System.out.println(1);
            Thread.sleep(500);
            System.out.println(2);
        } catch (InterruptedException exception){
            System.out.println(3);
        }
        System.out.println(4);
    }
}

```
- Suppose a thread with this runnable is started and immediately interrupted:
- ```

Thread t = new Thread(new MyRunnable());
t.start();
t.interrupt();

```
- What output is produced?
- (b) What are the two ways of implementing thread in Java? Provide necessary coding examples. 4.00
- (c) How do threads communicate with each other? 1.75

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B. Sc. (Engg.) Part-I Even Semester Examination 2019**  
**Course: ECON 1211 (Economics)**  
**Full Marks: 35                          Time: 2 Hours**

[Answer any Four questions taking two from each section]

**Section A**

- (1) a) Define economics. Distinguish between microeconomics and macroeconomics. 4  
b) What are the central economic problems of an economy? How these problems are solved in different economic systems? 4.75
- (2) a) Define demand and supply. 2  
b) Derive demand and supply curves from corresponding demand and supply schedules. 4  
c) What is elasticity of demand? Distinguish between arc elasticity and point elasticity with examples. 2.75
3. a) What are the characteristics of perfect competition and monopoly markets? 3  
b) Draw TC, AC, MC and TFC curves. 3  
c) Define market equilibrium and present market equilibrium graphically. How is equilibrium restored in a market? 2.75

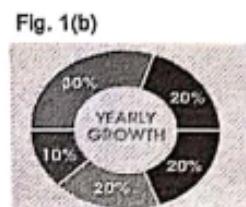
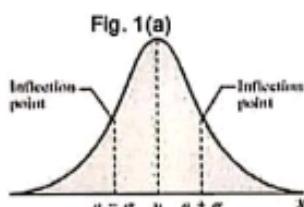
**Section B**

- (4) a) Distinguish between GDP and GNP with example. 3  
b) What is meant by Aggregate Demand (AD)? 1.75  
c) What is double counting problem? Give an example. 4
5. a) Explain the concepts of frictional, structural and cyclical unemployment with example. 3  
b) What is Philips curve? Draw short-run and long-run Philips curves. 3  
c) What is tax? Distinguish between direct tax and indirect tax with example. 2.75
- (6) a) What is a development plan? Write the principal characteristics of a development plan? 3  
b) Write the phases of development plan in Bangladesh since independence. 4  
c) What are the advantages of planning approach? 1.75

University of Rajshahi  
 Dept. of Computer Science and Engineering  
 B.Sc. Engg. Part-I, Even Semester, Examination 2020  
 Course Code: STAT 1211 Course Title: Statistics for Engineers  
**Time: 2 Hours**  
**Full Marks: 35**  
**[N.B. Answer FOUR questions taking at least TWO from each Section.]**

**Section-A**

- 1(a) Which of the given figure does present a descriptive statistics or an inferential statistics? Explain your answer.



3

- (b) The Chairman of the Dept. of Computer Science and Engineering wants to compare the academic performance between the students of session 2019 and 2020. He has the CGPA of all students and he wishes to get this comparison done by you since you have studied a course of Stat-1211. Explain the statistical approaches you may follow for this task. Mention pros and cons of those approaches if any.

- (c) The probability distribution is shown by the given figures. What will be approximate position of mode, median and mean? Explain your answer.



Fig. 1(c)

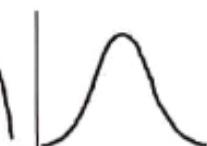


Fig. 1(d)



Fig. 1(e)

3

- 2(a) What is central tendency? Write down the measure of central tendency.

2.7

- (b) For non-zero positive observations show that  $AM \geq GM \geq HM$  (Notations are usual).

3

- (c) How can we measure the symmetry and asymmetry of a data distribution? Explain.

3

- 3(a) A box contains two Red balls. Another box of identical appearance contains one Red and one White ball. If a box is selected by chance and one ball is drawn from it, what is the probability that the first box was the selected one, if the drawn ball turns out to be Red?

4

- (b) A bag contains two white and four black balls. Two balls are drawn. In  $f(x, y)$ , let  $x$  and  $y$  represent the results of the two drawings; 0 corresponding to a black ball, 1 corresponding to a white ball. Find,  $f(0,1)$ ,  $f(0,0)$ ,  $f(1,0)$ ,  $f(1,1)$ , then from these four values, find  $f(0)$  and  $f(1)$ .

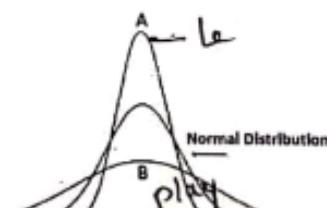
4.7

**Section-B**

- 4(a)  $X$  denotes (i) the chance of exact amount rain tomorrow, (ii) sum of the points obtained in rolling two dices, which one is discrete and which one is continuous random variable? And why?

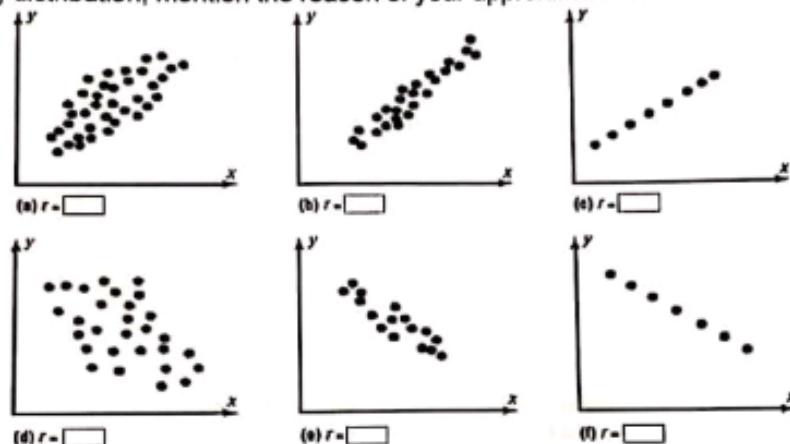
2

- (b) For the distribution given in the figure, between A and B, which one is platykurtic and which one is leptokurtic? Explain your answer.

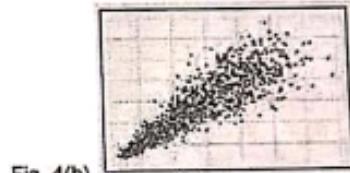


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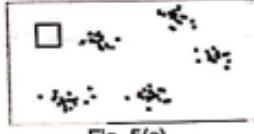
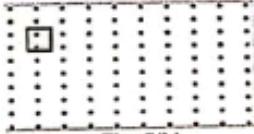
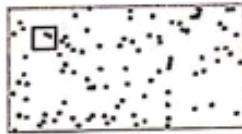
- (c) Interpret the distribution given below. Assign an approximate value of Correlation Coefficient for each of following distribution, mention the reason of your approximate values. 3



- (d) Which of the given figures, does not comply Pearson Correlation and why? 1.75

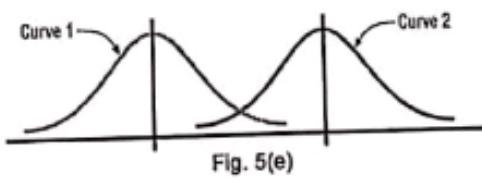
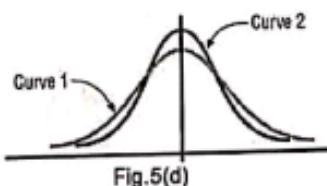


- 5(a) Mention, which of the given distribution complies with the assumption of Poisson distributions or not. Explain your answer. 3



- (b) A survey from Teenage Research Unlimited (Northbrook, Illinois) found that 30% of teenage consumers receive their spending money from part-time jobs. If 5 teenagers are selected at random, find the probability that at least 3 of them will have part-time jobs. 3.75

- (c) The both two curves in each figure present the Normal distribution. But what is the difference between two curves in each figure? 2



- 6(a) Define null hypothesis and alternative hypothesis. 2.75

- (b) Describe the test procedure for comparing two means. 3

- (c) How can you test differences of variances of two populations? Is it possible to test variances using t-test? Which statistical test is applicable for test of independence? 3

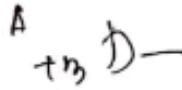
Section A

1. (a) What are the advantages of encoding a decimal number in BCD as compared to straight binary? What is its disadvantage? 2
- (b) What range of decimal values can be represented by a four-digit octal number? 1.75
- (c) A typical PC uses a 20-bit address code for its memory locations-
  - i) How many Hex digits are needed to represent a memory address?
  - ii) What is the range of addresses?
  - iii) What is the total number of memory locations?
- (d) Perform the subtractions  $(01001 - 11010)_2$  and  $(10010 - 10011)_2$  using 2's complement system. 2

2. (a) Draw the logic diagram and truth table of OR, NOR and XOR gate using NAND gate only. 3
- (b) Simplify the following Boolean expression 3
  - i)  $X = \overline{A}BC + A'\overline{B}C + AC + A'C'$
  - ii)  $A'B(D' + CD) + AB + A'BCD$
- (c) Which coding technique is good for error detection? Give example. Convert  $(10110)_2 = (?)_{\text{gray}}$ . 2.75

3. (a) Minimize the following function:  $f(a, b, c, d) = \sum m(1, 3, 4, 7, 11) + d(5, 12, 13, 14, 15)$  3
- (b) Define prime implicant with example. 1.75
- (c) Minimize the following function using Quine-McCluskey method. 4

$$f(a, b, c, d) = \sum_m (0, 1, 2, 4, 6, 8, 12, 14)$$



4. (a) Define the following terms: i) Fan out ii) Noise margin 2.75
- (b) Draw and explain the circuit operation of 2 digit TTL NAND gate. 3
- (c) Design a two input CMOS NAND gate with necessary diagram and truth table. 3

Section B

5. (a) Write down some benefits of clocked flip-flop. Discuss the circuit diagram of the edge triggered SR flip-flop with timing diagram. 4
- (b) Mention some applications of Latch. 1.75
- (c) Briefly explain the operation of master-slave flip-flop using logic and timing diagram. 3

6. (a) Draw the internal functional diagram of a 555 timer and explain its basic operation. What are the applications of 555 timer? 4.75
- (b) Draw the pin configuration of a 555 timer IC and explain the function of each pin. 4

7. (a) Define resolution or step size of a D/A converter. For a DAC, if step size is 0.1 V, then what will be the output voltage for a digital input 0001. 2.75
- (b) What is the advantage of R/2R ladder DAC over weighted registers DAC? Draw and explain the basic operation of R/2R ladder DAC. 3
- (c) What is the main advantage of a SAC over digital ramp ADC? An 8-bit SAC has resolution of 20 mV. What will its digital output be for an analog input of 2.17 V? Illustrate with diagram. 3

8. Write short notes on the following (any three): 8.75
  - (a) ECL NOR/OR gate
  - (b) Shift register
  - (c) Digital Ramp ADC
  - (d) 3 bit counter

University of Rajshahi  
 Department of Computer Science and Engineering  
 B.Sc. Engg. Part-I, Even Semester, Examination 2020

Course Code: MATH-1221

Course Title: Co-ordinate Geometry, Vector Analysis and Complex Variable

**Time: 3 Hours**

**Full Marks: 52.5**

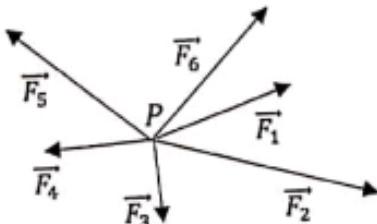
**[N.B. Answer SIX questions taking at least THREE from each Section.]**

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**Section-A**

1. ✓ (a) Construct the rotation matrix when the point is rotated through an angle  $\theta$ . 3.75  
 (b) If the point is rotated through  $45^\circ$ , find the new coordinates of the point whose coordinates are  $(1,1)$  using the rotation matrix. 3  
 (c) Prove that rotation is distance invariant. 2
- ✓ 2. (a) Rotate axes to eliminate the  $xy$ -term from the equation  $7x^2 - 6\sqrt{3}xy + 13y^2 - 16 = 0$  and draw the figure. 3  
 (b) What surfaces in  $\mathbb{R}^3$  are represented by the following equations? 1.75  
 (i)  $x = 5$     (ii)  $z = 4$ .  
 (c) A line makes angles  $\alpha, \beta, \gamma, \delta$  with the four diagonals of a cube; show that  $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma + \cos^2 \delta = \frac{4}{3}$ . 4
3. (a) Prove that the general equation of first degree in  $x, y, z$  i.e.,  $Ax + By + Cz + D = 0$  represents a plane. 3  
 (b) Find the equation of the straight lines through  $(2, -1, 4)$ , which are 2.75  
 (i) parallel to  $y$ -axis    (ii) perpendicular to  $y$ -axis.  
 (c) Find the shortest distance between the lines 3  

$$\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}; \quad \frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}. \quad 2\sqrt{29}$$
4. (a) Forces  $\vec{F}_1, \vec{F}_2, \vec{F}_3, \vec{F}_4, \vec{F}_5, \vec{F}_6$  act as shown on object  $P$ . What force is needed to prevent  $P$  from moving? 1.75



3

(b) Prove that  $\vec{A} \cdot (\vec{B} \times \vec{C}) = \vec{B} \cdot (\vec{C} \times \vec{A}) = \vec{C} \cdot (\vec{A} \times \vec{B})$ . 4

(c) Prove that  $[\vec{A} \times \vec{B} \vec{B} \times \vec{C} \vec{C} \times \vec{A}] = [\vec{A} \vec{B} \vec{C}]^2$ .

### Section-B

6

5. (a) A particle moves so that its position vector is given by  $\vec{r} = \cos \omega t \hat{i} + \sin \omega t \hat{j}$ , where  $\omega$  is a constant. Show that

- (i) the velocity  $\vec{v}$  of the particle is perpendicular to  $\vec{r}$ ,
- (ii) the acceleration  $\vec{a}$  is directed towards the origin and has magnitude proportional to the distance from origin, and
- (iii)  $\vec{r} \times \vec{v} = a$  constant vector.

- (b) If  $\vec{A}$  has constant magnitude, then show that  $\vec{A}$  and  $\frac{d\vec{A}}{dt}$  are perpendicular if  $\left| \frac{d\vec{A}}{dt} \right| \neq 0$ . 2.75

6. (a) Find the directional derivative of  $\phi = x^2yz + 4xz^2$  at  $(1, -2, -1)$  in the direction  $2\hat{i} - \hat{j} - 2\hat{k}$ . 2.75

- (b) Define divergence of a vector. If  $\phi = 2x^3y^2z^4$  then find  $\operatorname{div} \operatorname{grad} \phi$ . 3

- (c) Define curl of a vector. Prove that  $\operatorname{div} \operatorname{curl} \vec{A} = 0$  for any vector  $\vec{A}$ . 3

7. (a) If  $z_1$  and  $z_2$  are two complex numbers, then prove that  $|z_1 + z_2| \leq |z_1| + |z_2|$ . 3

- (b) Find the branch points and branch lines of the function  $f(z) = z^{\frac{1}{2}}$ . 3

- (c) State Cauchy's integral formula and explain why Cauchy's integral formula is quite remarkable. 2.75

8. (a) Evaluate  $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$  where  $C$  is the circle  $|z| = 3$ . 3

- (b) State residue theorem. 1.75

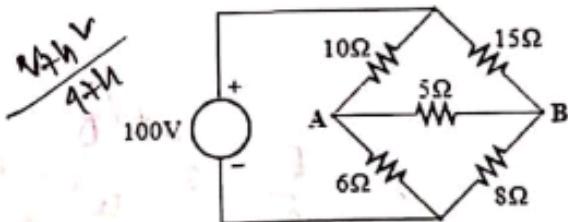
- (c) Evaluate  $\oint_C \frac{z}{(z-1)(z+1)^2} dz$  around the circle  $C$  defined by  $|z| = 2$  using residue theorem. 4

### Section A

- 1(a) Define electric field, electric dipole and dipole moment. 3
- 1(b) Show that  $\tau = \vec{P} \times \vec{E}$  for an electric dipole is placed in a uniform electric field  $\vec{E}$ . 2.75
- 1(c) An electric dipole of moment  $3 \times 10^{-9}$  cm is placed in a uniform field intensity  $1.5 \times 10^5$  NC $^{-1}$ . What does the maximum torque the field exert on the dipole? 3
- 2(a) State and prove Gauss's law in electrostatics. 4.75
- 2(b) A long cylinder of radius  $a$  is uniformly charged with charge density  $\lambda$  per unit length. Find the field  $E$  at points inside and outside the cylinder. 3
- 2(c) When do we apply Gauss's law? 1
- 3(a) State and prove Ampere's law for arbitrary path enclosing electric currents. 5.75
- 3(b) A solenoid has length 1.65 m and inner diameter 2.55 cm it carries a current 4.35 A. It consists of five closed packed layers, each with 150 turns along. What is the magnetic field  $B$  at its center? 3
- 4(a) Explain current density and drift velocity of a carrier. 2
- 4(b) Establish the relation between drift velocity and current density. 3
- 4(c) Calculate the drift velocity of free electron in copper from the following data:  
Current density =  $5 \times 10^6$  Am $^{-2}$ , density of copper =  $9000$  kg/m $^3$ , At wt. of copper 3.75  
64 gm/mole, Avogadro number =  $6 \times 10^{23}$  atoms/mole, electron charge =  $1.6 \times 10^{-19}$  C.

### Section B

- 5(a) State and prove maximum power transfer theorem. 4.75
- 5(b) Apply Thevenin's theorem to calculate the current through the  $5\Omega$  resistor of the circuit below:



$$V = \sum R$$

$$I = \frac{V}{R}$$

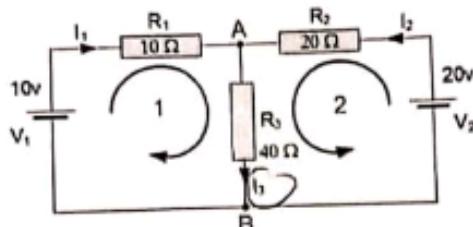
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6(a) What is alternating emf?

3

3(b) State and explain Kirchhoff's voltage law.

3.75

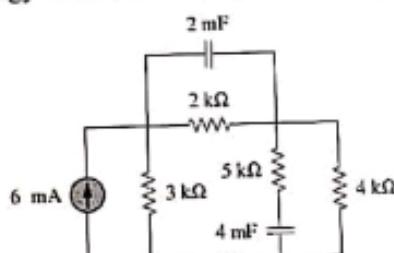
3(c) Consider the following circuit. Find the current flowing in the  $R_3$  resistor. Also calculate the voltage across it.

7(a) Show the current-voltage, voltage-current relationship and the energy stored in the capacitor.

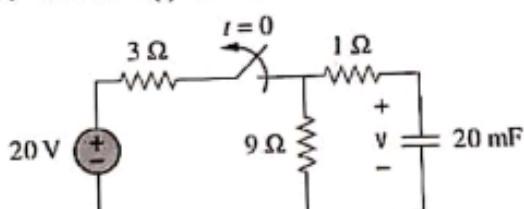
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7(b) Obtain the energy stored in each capacitor in figure below under dc conditions.

2.75

7(c) The switch in the circuit in figure below has been closed for a long time, and it is opened at  $t = 0$ . Find  $v(t)$  for  $t \geq 0$ . Calculate the initial energy stored in the capacitor.

3

 $C =$ 

8(a) Explain reactance and impedance of an AC circuit.

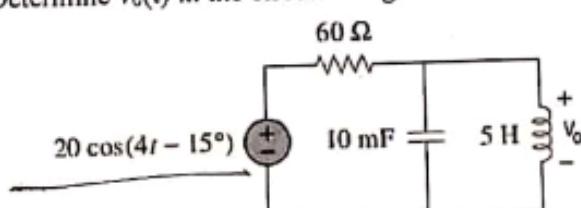
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8(b) Show the voltage-current relation for an inductor and a capacitor in the time domain and in the frequency domain with phasor diagram.

3.75

8(c) Determine  $v_o(t)$  in the circuit in figure below:

2



University of Rajshahi

Dept. of Computer Science and Engineering

B.Sc. Engg. Part-I, Even Semester, Examination 2020

Course Code: ECON 1211 Course Title: Engineering Economics

Time: 2 Hours

Full Marks: 35

[N.B. Answer FOUR questions taking at least TWO from each Section.]

**Section A**

- (a) Define engineering economy. Why is it important for engineers to study engineering economy? 4
- (b) Distinguish, with an example, between simple and compound interest rates. 4.75
- (a) What is cash flow? Draw cash flow diagrams from both a borrower's point of view and a lender's point of view. 2
- (b) Explain the concept of arithmetic gradient with figures. 2
- (c) A construction firm pays \$5,000.00 for the first year of a maintenance service contract that increases by \$1,000.00 in each subsequent year until year six. If the interest rate is 6%, calculate the present worth of the uniform annual series and the gradient. 4.75
- (a) Distinguish between nominal interest rate and effective interest rate. 2
- (b) Three different bank loan rates for electric generation equipment are listed below. Determine the effective rate on the basis of the compounding period for each rate. 4.75
- i) 9% per year, compounded quarterly.  
ii) 9% per year, compounded monthly.  
iii) 4.5% per 6 months, compounded weekly.
- (c) What is effective annual interest rates? 2

**Section B**

- (a) What is the primary purpose of a public sector project? 1
- (b) Explain how public projects are different from private projects. 3
- (c) Distinguish between the conventional B/C ratio and the modified B/C ratio for a single project. 4.75
- (a) What do you mean by inflation? How does inflation happen? 4
- (b) Derive and show the relationship between market interest rate, real interest rate and the inflation rate. 2
- (c) Money in a medium-risk investment makes a guaranteed 8% per year. Inflation rate has averaged 5.5% per year. What is the real rate of return on the investment? 2.75
- (a) What are the main elements of after tax cash flows? 2
- (b) A medium-sized profitable corporation may buy a \$15,000 used pickup truck for use by the shipping and receiving department. During the truck's 5-year useful life, it is estimated the firm will save \$4000 per year after all the costs of owning and operating the truck have been paid. Truck salvage value is estimated at \$4500.  
i) What is the before-tax rate of return?  
ii) What is the after-tax rate of return on this capital expenditure? Assume straight-line depreciation. 6.75

**Section- A**

- 1.(a) Which of the following are legal identifiers in Java? 1.75  
 (i)g (ii)void (iii)101dalmatians (iv)Hello, World (v)<greeting>

- (b) What does this sequence of statements print? 1.50  
 Rectangle box = new Rectangle(5, 10, 20, 30);  
 System.out.println("Before: " + box.getWidth());  
 box.translate(25, 40);  
 System.out.println("After: " + box.getWidth());

- (c) What is encapsulation? Why is it useful? 2.00

- (d) Consider the following implementation of a class Square : 2.00  
 public class Square{  
 private int sideLength;  
 private int area; // Not a good idea  
 public Square(int length){  
 sideLength = length;  
 }  
 public int getArea(){  
 area = sideLength \* sideLength;  
 return area;  
 }  
}

Why is it not a good idea to introduce an instance variable for the area? Rewrite the class so that area is a local variable.

- (e) Write the difference between equals() method and equality operator (==) in Java. 1.50

- 2.(a) What is vector? How is it different from an array? 2.75

- (b) How does String class differ from the StringBuffer class? Explain with example. 3

- (c) Write a method called 3  
 delete (String str, int m)

that returns the input string with the m<sup>th</sup> element removed.

- 3.(a) What do these loops print by given the variables 2.00

String stars = "\*\*\*\*\*";

String stripes = "=====";

(i) int i = 0;

while (i < 5){

System.out.print(stars.substring(0, i));

System.out.println(stripes.substring(i, 5));

i++;

}