



The Open University of Sri Lanka
Continuing Education/Stand alone courses in Science
Final Examination 2010/2011
PSE 3117 – Mathematics for Chemistry and Biology
(2 hours)

15th December 2010

9.30a.m. – 11.30 a.m.

- This paper has eight questions. Total marks awarded = 440 මෙම ප්‍රශ්න පත්‍රයේ ප්‍රශ්න අටක් අන්තර්ගත වේ. සම්පූර්ණ ලකුණු 440 ක් ප්‍රදානය කරනු ලැබේ.
- Attempt all the questions. All those scoring about 400 or more would be deemed to have scored 100%; pro rata marks would be awarded to other candidates. සියළුම ප්‍රශ්න වලට පිළිතුරු සැපයීමට උත්සාහ කරන්න. ලකුණු 400ක් හෝ ඊට වඩා ලකුණු ලබා ගන්නා සිසුන්ට 100% ක් ද අනෙකුත් සිසුන්ට සමානුපාතිකව ද ලකුණු ලැබෙනු ඇත.
- The use of nonprogrammable electronic calculator is permitted. ප්‍රකුමණය කළ නොහැකි ගණක යන්ත්‍ර භාවිතා කළ හැක.
- Clearly write down all relevant steps in answering the questions. පිළිතුරු සැපයීමේදී අදාළ සියළුම පියවර දක්වන්න.

1.(a) Solve විසඳන්න (i) $2x + 3 + \frac{1}{x} = 0 \quad (x \neq 0)$

(ii) $3^{2x+1} - 10(3^x) + 3 = 0$

(20 marks)

- (b) Simplify the following expression and give the answer in the form of a complex number, $a + ib$:

පහත දක්වා ඇති ප්‍රකාශනය සුළුකර පිළිතුර $a + ib$ ආකාරයේ සංකීර්ණ සංඛ්‍යාවක් මගින් ප්‍රකාශ කරන්න.

$$\left[\frac{5(1+i)}{(2-i)} \right]^2$$

(20 marks)

2(a) Show that $\log_{10} \left(\frac{A}{B} \right) = \log_{10} A - \log_{10} B$ බව පෙන්වන්න.

(b) If $\log_{10} Y! = Y \log_{10} Y - Y$, show that $Y! = \left(\frac{Y}{10} \right)^Y$

$$\log_{10} Y! = Y \log_{10} Y - Y, \text{ නම් } Y! = \left(\frac{Y}{10}\right)^Y \text{ බව පෙන්වන්න.}$$

- (c) Calculate, **without the use of a calculator or the logarithmic tables**, the following
ගණක යන්ත්‍ර හෝ ලඝු ගණක වක්‍ර භාවිතා නොකර පහත දැක්වෙන දෑ ගණනය කරන්න.

$$\left[\frac{\log_4 64 + \log_5 25}{\log_{10} 0.01} \right] [\log_2 0.5] + \frac{2}{3} (\log_3 \sqrt{81}) (\log_{25} 125)$$

(40 marks)

- (d) Find the value/s of θ (in the range 0 to 180°) that satisfy the equation $\cos^2\theta + 3\sin^2\theta - 2 = 0$.
 $\cos^2\theta + 3\sin^2\theta - 2 = 0$ යන සමීකරනය කාළක කරන 0 සහ 180° අතර පරාසයේ θ හි අගය සොයන්න.

(20 marks)

- 3.(a) **From first principals** differentiate $y = (1-x)^2$ with respect to x .
ප්‍රථම මූල ධර්ම මගින් $y = (1-x)^2$ යන්න x විෂයයෙන් අවකලනය කරන්න.

(20 marks)

- (b) Find the first differential of the following functions:
පහත දක්වා ඇති ශ්‍රිතයන්හි ප්‍රථම අවකලන සංගුණකය සොයන්න.

$$(i) u = \sqrt{(x+1)^3} \quad (ii) y = \frac{1+x^2}{1-2x} \quad (iii) y = (\sin 3\theta \cdot \cos \theta)$$

(35 marks)

- 4.(a) Evaluate the following integrals: පහත දක්වා ඇති අනුකල අගයන්න.

$$(i) \int \left(2\sqrt{x} + \frac{1}{1-x} \right) dx \quad (ii) \int \frac{\cos \theta}{2 \sin \theta - 1} d\theta$$

$$(iii) \int \frac{x-1}{x^2-2x-3} dx \quad (iv) \int \cos^2 x dx$$

(40 marks)

- (b) (i) Determine the value of $\int_0^{\frac{\pi}{3}} 2 \sin 3\theta \cos 3\theta d\theta$ යන්නෙහි අගය සොයන්න.

(ii) Given that $\int_b^a (2x-1) dx = 4$ and that $b-a=2$, find the values of a and b

$\int_b^a (2x-1)dx = 4$ සහ $b - a = 2$ බව දී ඇති විටදී a සහ b හි අගයන් සොයන්න.

(25 marks)

5. Consider the function, $f(P,V,T) = \frac{2T}{\sqrt{PV}}$ යන ශ්‍රිතය සලකන්න.

Show that $\left[\frac{\partial}{\partial T} \left(\frac{\partial f}{\partial P} \right)_{T,V} \right]_{P,V} = \left[\frac{\partial}{\partial P} \left(\frac{\partial f}{\partial T} \right)_{P,V} \right]_{T,V}$ බව පෙන්වන්න.

(25 marks)

6 (a) The gradient of a curve (of the form $y = f(x)$) is given as $\frac{dy}{dx} = 3(x-1)(x+2)$.

The point (0,1) lies on this curve.

$y = f(x)$ ආකාරයේ වක්‍රයක අනුක්‍රමණය $\frac{dy}{dx} = 3(x-1)(x+2)$. යන්තෙන් දී ඇත. (0,1) ලක්ෂ්‍යය වක්‍රය මත පිහිටා ඇත

(i) Find the equation of this curve. මෙම වක්‍රයේ සමීකරණය සොයන්න.

(ii) Determine the turning points and identify them as maxima, minima or points of inflexion. වර්තන ලක්ෂ්‍ය සොයා ඒවා උපරිම අවම හෝ නිශ්චර්තන වේ දැයි නිශ්චය කරන්න.

(35 marks)

(b) Show that $f(V,T) = TV^{r-1}$ is a homogeneous function and that, it satisfies the Eulers Theorem.

$f(V,T) = TV^{r-1}$ සමජාතීය ශ්‍රිතයක් බව පෙන්වා එය ඔයිලර් ප්‍රමේය තෘප්ත කරන බව පෙන්වන්න.

(20 marks)

7 (a)

(i) Three coins are flipped at the same time by three individuals . Two coins are unbiased. (having equal chance of landing either head or tail) For the third coin the probability of landing a head is 2/3. What is the probability that all three coins come up heads.

කාසි තුනක් එකවර උඩ දමනු ලැබේ. මින් කාසි දෙකක් සමබර වන (H සහ T ලැබීමේ සමාන හැකියාවන් ඇති) අතර අනෙක් කාසියේ හිස (H) ලැබීමේ සම්භාවිතාවය 2/3 වේ. කාසි තුනම හිස (H) ලබාදීමේ සම්භාවිතාව සොයන්න.

(ii) In a MCQ paper, each question has five choices of which only one answer is correct. The paper consists of 10 such questions and a candidate decides to choose the answers for all 10 questions randomly. Find the probability that this candidate marks 3 correct answers.

බහුවරණ ප්‍රශ්න පත්‍රයක සෑම ප්‍රශ්නයක් සඳහාම පිළිතුරු පහක් දී ඇති අතර ඒ අතුරින් එක් පිළිතුරක් පමණක් නිවැරදිය. ප්‍රශ්න පත්‍රයේ එවැනි ප්‍රශ්න 10 ක් ඇති අතර විභාග අපේක්ෂකයෙකු සියළුම ප්‍රශ්න සඳහා අහඹු ලෙස පිළිතුරු ලකුණු කරයි. ඔහු නිවැරදි පිළිතුරු 3 ක් ලකුණු කිරීමේ සම්භාවිතාව සොයන්න.

(40 marks)

(b) In how many ways can 3 novels, 2 mathematics books and 1 chemistry book be arranged in a book shelf if,

- (i) the books can be arranged in any order,
 (ii) the mathematics books must be together and the novels must be together

නව කතා පොත් 3 ක් ගණිත පොත් 2 ක් සහ එක් රසායන විද්‍යා පොතක්

- (i) පොත් රාක්කයක තැන්පත් කළ හැකි සියළුම ආකාර ගණන සොයන්න.
 (ii) ගණිත පොත් එක ලඟින් ද නව කතා පොත් එක ලඟින් ද පිහිටන අන්දමට ඉහත පොත් පිළියෙල කළ හැකි ආකාර ගණන කොපමණද

(30 marks)

(8) (a) Twenty five students were asked to draw a line segment of about 30 cm long. Their responses were measured in cm and recorded in the following table.

ශිෂ්‍යයන් 25 දෙනෙකුට සෙ.මී 30 ක් දිග සරල රේඛා අඳින ලෙස නියෝග කරන ලදී. එක් එක් ශිෂ්‍යයා විසින් අඳින ලද රේඛා වල දිග නිවැරදිව මැන පහත දක්වා ඇති වගුවේ සටහන් කර ඇත.

26.4	29.1	31.1	25.7	28.2
31.7	26.8	30.9	27.5	30.4
30.8	31.0	32.2	27.3	31.2
29.2	32.8	30.7	27.9	28.4
30.3	29.2	25.6	25.1	26.3

Group the data into 8 intervals of equal class width such that the first class interval should be 25.0 cm - 25.9 cm. Carry out the following for the above data.

පළමුවන පන්ති ප්‍රාන්තරය 25.0 cm - 25.9 cm වන සමාන ප්‍රාන්තර 8 කට ඉහත දත්ත සමූහගත කරන්න.

- (i) Construct the frequency table and draw a histogram. සංඛ්‍යාත වගුව ගොඩ නගා ජාල රේඛය අඳින්න.
 (ii) Calculate the classified mean of above data. ඉහත සමූහගත කළ දත්තයන්ගේ මධ්‍යන්‍ය සොයන්න.

(50 marks)

(b) The mean age of a combined group of men and women is 31 years. If the mean age of this group of men is 32 and that of the group of women is 28, find out the percentage of men in the group. මිනිසුන් සහ ගැහැණුන් පිරිසකගේ මධ්‍යන්‍ය වයස අවුරුදු 31 ක් වේ. මෙම කන්ඩායමේ පිරිමින්ගේ මධ්‍යන්‍ය වයස 32 ක් සහ ගැහැණුන්ගේ මධ්‍යන්‍ය වයස 28 ක් වේ නම් කන්ඩායමේ සිටින පිරිමින්ගේ ප්‍රතිශතය ගණනය කරන්න.

(20 marks)



இலங்கைத் திறந்த பல்கலைக்கழகம்
தொடரும் கல்வி/விஞ்ஞானத்தில் சாராப் பயிற்சிக்கூறு
PSE 3117 – இரசாயனம், உயிரியலுக்கான கணிதம்
இறுதிப் பரீட்சை 2010/2011

காலம்: இரண்டு மணித்தியாலங்கள்

15.12.2010

மு.ப 9.30 – மு.ப 11.30

- This paper has eight questions. Total marks awarded = 440
இவ்வினாத்தாள் எட்டு வினாக்களைக் கொண்டுள்ளது. ஒதுக்கப்பட்ட மொத்த புள்ளிகள் = 440.
- Attempt all the questions. All those scoring about 400 or more would be deemed to have scored 100%; pro rata marks would be awarded to other candidates.
சகல வினாக்களையும் முயற்சிக்க. 400 அல்லது அதற்கு மேற்பட்ட புள்ளிகளைப் பெறுபவர்களுக்கு 100% புள்ளிகள் வழங்கப்படும். ஏனையவர்களுக்கு வீதாசாரப்படி புள்ளிகள் வழங்கப்படும்.
- The use of nonprogrammable electronic calculator is permitted.
நெறிப்படுத்தப்படாத கணினியின் உபயோகம் அனுமதிக்கப்பட்டுள்ளது.
- Clearly write down all relevant steps in answering the questions.
வினாக்களுக்கு விடையளிக்கையில் தேவையான சகல படிகளையும் தெளிவாக எழுதுக.

1. (a) Solve /தீர்க்க

$$(i) \quad 2x + 3 + \frac{1}{x} = 0 \quad (x \neq 0)$$

$$(ii) \quad 3^{2x+1} - 10(3^x) + 3 = 0$$

(20 புள்ளிகள்)

(b) Simplify the following expression and give the answer in the form of a complex number, $a + ib$:

பின்வரும் கோவையை எளிதாக்கி, விடையை $a + ib$ எனும் சிக்கல் எண் வடிவத்தில் தருக.

$$\left[\frac{5(1+i)}{2-i} \right]^2$$

(20 புள்ளிகள்)

2 (a) Show that $\log_{10} \left(\frac{A}{B} \right) = \log_{10} A - \log_{10} B$

$\log_{10} \left(\frac{A}{B} \right) = \log_{10} A - \log_{10} B$ எனக் காட்டுக.

(b) If $\log_{10} Y! = Y \log_{10} Y - Y$, show that $Y! = \left(\frac{Y}{10}\right)^Y$

$\log_{10} Y! = Y \log_{10} Y - Y$ எனின், $Y! = \left(\frac{Y}{10}\right)^Y$ எனக் காட்டுக.

(c) Calculate, **without the use of a calculator or the logarithmic tables**, the following
பின்வருவதை கணினியையோ அல்லது மடக்கை அட்டவணையையோ பயன்படுத்தாது கணிக்குக.

$$\left[\frac{\log_4 64 + \log_5 25}{\log_{10} 0.01} \right] [\log_2 0.5] + \frac{2}{3} (\log_3 \sqrt{81}) (\log_{25} 125)$$

(40 புள்ளிகள்)

(d) Find the value/s of θ (in the range 0 to 180°) that satisfy the equation $\cos^2 \theta + 3\sin^2 \theta - 2 = 0$.
 $\cos^2 \theta + 3\sin^2 \theta - 2 = 0$ எனும் சமன்பாட்டைத் திருப்திப்படுத்தும் θ வினாடைய பெறுமானங்களைக் ($0 - 180^\circ$ எனும் வீச்சத்தில்) காண்க.

(20 புள்ளிகள்)

3. (a) **From first principles** differentiate $y = (1-x)^2$ with respect to x .

முதற் கோட்பாடுகளிலிருந்து $y = (1-x)^2$ இனை x குறித்து வகைப்படுத்துக.

(20 புள்ளிகள்)

(b) Find the first differential of the following functions:

பின்வரும் சார்புகளின் முதல் வகையீட்டைக் காண்க.

(i) $u = \sqrt{(x+1)^3}$

(ii) $y = \frac{1+x^2}{1-2x}$

(iii) $y = (\sin 3\theta \cdot \cos \theta)$

(35 புள்ளிகள்)

4. (a) Evaluate the following integrals.

பின்வரும் தொகையீடுகளைத் தீர்க்க.

(i) $\int \left(2\sqrt{x} + \frac{1}{1-x} \right) dx$

(ii) $\int \frac{\cos \theta}{2 \sin \theta - 1} d\theta$

(iii) $\int \frac{x-1}{x^2-2x-3} dx$

(iv) $\int \cos^2 x dx$

(40 புள்ளிகள்)

(b) (i) Determine the value of $\int_0^{\frac{\pi}{3}} 2 \sin 3\theta \cos 3\theta d\theta$

$\int_0^{\frac{\pi}{3}} 2 \sin 3\theta \cos 3\theta d\theta$ என்பதன் பெறுமானத்தைத் தீர்மானிக்க.

(ii) Given that $\int_b^a (2x-1)dx = 4$ and that $b-a=2$, find the values of a and b

$\int_b^a (2x-1)dx = 4$, $b-a=2$, எனத் தரப்பட்டுள்ளது. a, b யினது பெறுமானங்களைக் காண்க.

(25 புள்ளிகள்)

5. Consider the function, $f(P,V,T) = \frac{2T}{\sqrt{PV}}$

$f(P,V,T) = \frac{2T}{\sqrt{PV}}$ எனும் சார்பினைக் கருதுக.

Show that $\left[\frac{\partial}{\partial T} \left(\frac{\partial f}{\partial P} \right)_{T,V} \right]_{P,V} = \left[\frac{\partial}{\partial P} \left(\frac{\partial f}{\partial T} \right)_{P,V} \right]_{T,V}$

$\left[\frac{\partial}{\partial T} \left(\frac{\partial f}{\partial P} \right)_{T,V} \right]_{P,V} = \left[\frac{\partial}{\partial P} \left(\frac{\partial f}{\partial T} \right)_{P,V} \right]_{T,V}$ எனக் காட்டுக.

(25 புள்ளிகள்)

6 (a) The gradient of a curve of the form $y = f(x)$ is given as $\frac{dy}{dx} = 3(x-1)(x+2)$.

The point $(0,1)$ lies on this curve.

$y = f(x)$ எனும் வளையி ஒன்றின் படித்திறன் $\frac{dy}{dx} = 3(x-1)(x+2)$ எனத் தரப்பட்டுள்ளது. $(0,1)$ எனும் புள்ளி இவ்வளையியில் காணப்படுகின்றது.

(i) Find the equation of this curve/இவ்வளையியின் சமன்பாட்டைக் காண்க

(ii) Determine the turning points and identify them as maxima, minima or points of inflexion.

திரும்பற் புள்ளிகளைத் தீர்மானித்து அவை உயர்வானவையா தாழ்வானவையா அல்லது விபத்திப் புள்ளிகளாக என அடையாளம் காண்க.

(35 புள்ளிகள்)

- (b) Show that $f(V, T) = TV^{\gamma-1}$ is a homogeneous function and that, it satisfies the Eulers Theorem.

$f(V, T) = TV^{\gamma-1}$ ஓர் ஓரினமான சார்பு எனவும், இது Eulers தேற்றத்தைத் திருப்திப்படுத்துகின்றது எனவும் காட்டுக. (20 புள்ளிகள்)

7 (a)

- (i) Three coins are flipped at the same time by three individuals . Two coins are unbiased. having equal chance of landing either head or tail) For the third coin the probability of landing a head is $2/3$. What is the probability that all three coins come up heads.

ஓரே நேரத்தில் மூன்று பேரினால் மூன்று நாணயங்கள் சுண்டப்படுகின்றன. இரண்டு நாணயங்கள் பாரபட்சமற்றவை (தலை அல்லது வால் விழுவதற்கு சமனான சந்தர்ப்பம் கொண்டுள்ளன). மூன்றாவது நாணயத்திற்கு தலை விழுவதற்கான நிகழ்தகவு $2/3$ ஆகும். மூன்று நாணயங்களும் தலைகளாக வீழ்வதற்கான நிகழ்தகவு யாது?

- (ii) In a MCQ paper, each question has five choices of which only one answer is correct. The paper consists of 10 such questions and a candidate decides to choose the answers for all 10 questions randomly. Find the probability that this candidate marks 3 correct answers.

MCQ வினாத்தாள் ஒன்றில், ஒவ்வொரு வினாவிற்கும் 5 தெரிவுகள் காணப்படுகின்றன. அவற்றுள் ஒன்று மாத்திரம் திருத்தமானது. வினாத்தாள் இவ்வாறான 10 வினாக்களைக் கொண்டுள்ளது, அத்துடன் பரீட்சார்த்தி சகல 10 வினாக்களுக்கும்மான விடைகளை எழுந்தமானதாகத் தெரிவு செய்யத் தீர்மானித்தார். இப் பரீட்சார்த்தி மூன்று திருத்தமான விடைகளுக்குப் புள்ளியிடுவதற்கான நிகழ்தகவைக் காண்க.

(40 புள்ளிகள்)

- (b) In how many ways can 3 novels, 2 mathematics books and 1 chemistry book be arranged in a book shelf if,

- (i) the books can be arranged in any order,
(ii) the mathematics books must be together and the novels must be together

3 நாவல்கள், 2 கணிதப் புத்தகங்கள், 1 இரசாயனப் புத்தகம் என்பவற்றினை

- (i) புத்தகங்களை எந்தவொரு வரிசையிலும்,
(ii) கணிதப் புத்தகங்கள் ஒன்றாகவும், நாவல்கள் ஒன்றாகவும் அடுக்கப்படுமாயின் எத்தனை வழிகளில் ஒழுங்குபடுத்தப்படலாம்.

(30 புள்ளிகள்)

- (8) (a) Twenty five students were asked to draw a line segment of about 30 cm long. Their responses were measured in cm and recorded in the following table.

30 cm நீளமுடைய கோடு ஒன்றினை வரையுமாறு 25 மாணவர்கள் வேண்டப்பட்டார்கள். அக் கோடுகள் cm இல் அளக்கப்பட்டு பின்வருமாறு அட்டவணைப்படுத்தப்பட்டுள்ளது.

26.4	29.1	31.1	25.7	28.2
31.7	26.8	30.9	27.5	30.4
30.8	31.0	32.2	27.3	31.2
29.2	32.8	30.7	27.9	28.4
30.3	29.2	25.6	25.1	26.3

Group the data into 8 intervals of equal class width such that the first class interval should be 25.0 cm - 25.9 cm. Carry out the following for the above data..

முதல் வகுப்பு இடைவெளி 25.0 cm - 25.9 cm ஆக இருக்குமாறு தரவுகளை 8 சமனான வகுப்பு இடைவெளிகளாகக் கூட்டப்படுத்துக. மேந்தரப்பட்ட தரவுகளிலிருந்து பின்வருவனவற்றிற்கு விடையளிக்க.

- (i) Construct the frequency table and draw a histogram.

மீடறன் அட்டவணையை வரைந்து அத்துடன் வலையுரு வரையத்தையும் வரைக.

- (ii) Calculate the classified mean of above data.

மேந்தரப்பட்ட தரவுகளின் உத்தேச இடையைக் கணிக்க.

(50 புள்ளிகள்)

- (b) The mean age of a combined group of men and women is 31 years. If the mean age of this group of men is 32 and that of the group of women is 28, find out the percentage of men in the group.

பெண்களையும் ஆண்களையும் கொண்ட கூட்டமொன்றின் சராசரி வயது 31 வருடங்கள். இக் கூட்டத்திலுள்ள ஆண்களின் சராசரி வயது 32 ஆகவும், பெண்களின் சராசரி வயது 28 ஆகவும் காணப்படுமாயின், இக் கூட்டத்திலுள்ள ஆண்களின் வீதத்தைக் காண்க.

(20 புள்ளிகள்)

(பதிப்புரிமை பெற்றது)