FALLFR2122CAT1_VL2021220106154_BMAT101L_OCT21_BALA ANKI REDDY POL (#26674)

Total Marks: 30

Total Duration: 60 minutes

Instructions

Basic Instructions

1. You can freely navigate between different questions forward and backward using **Next** and **Previous** buttons
2. **Finish** button will be enabled only towards the end of the exam.

Instructions for DESCRIPTIVE questions requiring SCAN & UPLOAD

1. Make sure to upload your **scans immediately after you answer** every question. Do NOT wait till the end to **avoid panic at the end**.
2. The exam time is inclusive of time for scanning & uploading answers.
3. If using **laptop + mobile** for the exam, click on **Open Test** on laptop and click on **Scan & Upload** on mobile.
4. If using **laptop + mobile** for the exam, when scanning and uploading from mobile, ensure that the correct question is open on the laptop.
5. When clicking on Camera button on a smart phone for scanning and uploading, you have 2 camera applications available to scan the answer: your phone's **native camera** and an alternative Low Memory Camera. Click on the **Low Memory Camera** in case your browser shows an error due to low memory.

Section: Module 1

Marks per question: 10

1 question(s) out of the 4 question(s) in this section will be shown to examinee

Examinee should answer all 1 question(s) in this section

Q1 Difficulty Level: Medium

Knowledge Level: K1 **Course Outcomes: CO1**

(i) Show that $1+x<e^x<1+xe^x, x>0$ by mean value theorem.

(ii) Let $h(t)=5-\frac{1}{9}\sqrt[3]{(8-3t)^6}$ models the biomass (total mass of the members of the population) in kilograms of a mice population after t months. Graph the function, determine when the population increases at a smallest rate and determine also that rate and the biomass at that time.

Q2 Difficulty Level: Medium

Knowledge Level: K1 **Course Outcomes: CO1**

(i) Show that $2+2x<2e^x<2+2xe^x,\ x>0$ by mean value theorem.

(ii) Let $f(t)=10-\frac{2}{9}\sqrt[3]{(8-3t)^7}$ models the biomass (total mass of the members of the population) in kilograms of a mice population after t months. Graph the function, determine when the population increases at a smallest rate and determine also that rate and the biomass at that time.

Q3 Difficulty Level: Medium

Knowledge Level: K1 **Course Outcomes: CO1**

(i) Show that $3+3x<3e^x<3+3xe^x,\ \ x>0$ by mean value theorem.

(ii) Let $k(t)=15-\frac{3}{9}\sqrt[3]{(8-3t)^8}$ models the biomass (total mass of the members of the population) in kilograms of a mice population after t months. Graph the function, determine when the population increases at a smallest rate and determine also that rate and the biomass at that time.

Q4 Difficulty Level: Medium

Knowledge Level: K1 **Course Outcomes:** CO1

(i) Show that $4+4x<4e^{x}<4+4xe^{x},\ x>0$ by mean value theorem.

(ii) Let $g(t)=20-\frac{4}{9}\sqrt[3]{(8-3t)^{4}}$ models the biomass (total mass of the members of the population) in kilograms of a mice population after t months. Graph the function, determine when the population increases at a smallest rate and determine also that rate and the biomass at that time.

Section: Module 1

Marks per question: 10

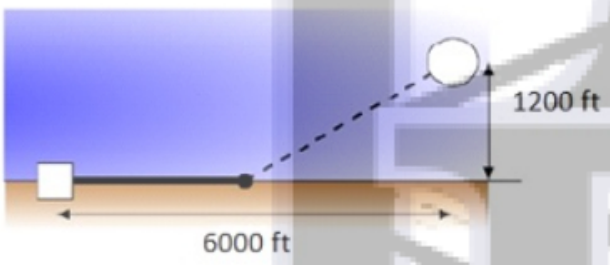
1 question(s) out of the 4 question(s) in this section will be shown to examinee

Examinee should answer all 1 question(s) in this section

Q1 **Difficulty Level: Hard**

Knowledge Level: K1 **Course Outcomes:** CO1

A power line needs to be run from a power station located on the beach to an offshore facility and the below figure shows the distances between the power station to the facility. It costs \$60/ft. to run a power line along the land, and \$120/ft. to run a power line under water. How much of the power line should be run along the land to minimize the overall cost? What is the minimal cost?



Q2 **Difficulty Level: Hard**

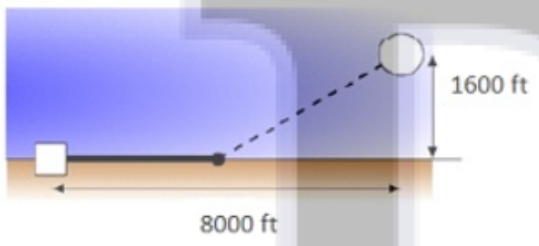
Knowledge Level: K1 **Course Outcomes:** CO1

A power line needs to be run from a power station located on the beach to an offshore facility and the below figure shows the distances between the power station to the facility. It costs \$40/ft. to run a power line along the land, and \$80/ft. to run a power line under water. How much of the power line should be run along the land to minimize the overall cost? What is the minimal cost?

Q3 **Difficulty Level: Hard**

Knowledge Level: K1 **Course Outcomes:** CO1

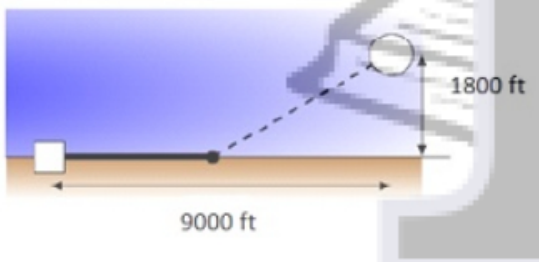
A power line needs to be run from a power station located on the beach to an offshore facility and the below figure shows the distances between the power station to the facility. It costs \$70/ft. to run a power line along the land, and \$140/ft. to run a power line under water. How much of the power line should be run along the land to minimize the overall cost? What is the minimal cost?



Q4 **Difficulty Level: Hard**

Knowledge Level: K1 **Course Outcomes:** CO1

A power line needs to be run from a power station located on the beach to an offshore facility and the below figure shows the distances between the power station to the facility. It costs \$80/ft. to run a power line along the land, and \$160/ft. to run a power line under water. How much of the power line should be run along the land to minimize the overall cost? What is the minimal cost?



Section: Module 2

Marks per question: 10

1 question(s) out of the 4 question(s) in this section will be shown to examinee

Examinee should answer all 1 question(s) in this section

Q1 Difficulty Level: Medium

Knowledge Level: K1 **Course Outcomes:** CO2

(i) If $\theta = t^n e^{-\frac{r^2}{4t}}$, find what value of n will make $\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial\theta}{\partial r}\right) = \frac{\partial\theta}{\partial t}$.

(ii) Let $u = \frac{x+y}{1-xy}, v = \frac{(x+y)(1-xy)}{(1+x^2)(1+y^2)}$. Then verify u and v are functionally dependent and if so, find the relation between them.

Q2 Difficulty Level: Medium

Knowledge Level: K1 **Course Outcomes:** CO2

(i) If $\theta = \frac{1}{t^{-n}e^{\frac{r^2}{4t}}}$, find what value of n will make $\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial\theta}{\partial r}\right) = \frac{\partial\theta}{\partial t}$.

(ii) Let $u = \frac{2x+2y}{2-2xy}, v = \frac{(x+y)(1-xy)}{(1+x^2)(1+y^2)}$.

Then verify u and v are functionally dependent and if so, find the relation between them.

Q3 Difficulty Level: Medium

Knowledge Level: K1 **Course Outcomes:** CO2

(i) If $\theta = \frac{t^n}{e^{\left(\frac{r}{2}\right)^2\frac{1}{t}}}$, find what value of n will make $\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial\theta}{\partial r}\right) = \frac{\partial\theta}{\partial t}$.

(ii) Let $u = \frac{x+y}{1-xy}, v = \frac{(2x+2y)(1-xy)}{(1+x^2)(2+2y^2)}$. Then verify u and v are functionally dependent and if so, find the relation between them.

Q4 Difficulty Level: Medium

Knowledge Level: K1 **Course Outcomes:** CO2

(i) If $\theta = \frac{e^{-\left(\frac{r}{2}\right)^2 \frac{1}{t}}}{t^{-n}}$, find what value of n will make $\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2 \frac{\partial \theta}{\partial r}\right) = \frac{\partial \theta}{\partial t}$.

(ii) Let $u = \frac{x+y}{1-xy}, v = \frac{(x+y)(3-3xy)}{(3+3x^2)(1+y^2)}$. Then verify u and v are functionally dependent and if so, find the relation between them.