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16/4/20 Date	4
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HEAT ASSIGNMENT-4 UMANG	W.
EQUATION 2018 VIC 312=	7
ICE-2	
4. L - X	
Ques 1. A rod of length 'l' with insulated	6
sides is initially at a temperature	6
Mo(X). Its ends are suddenly cooled	
to O'C and are kept at that temperar	ful.
Plone that the temp for $u(x,t)$ is given by $u(x,t) = \sum_{n=0}^{\infty} b_n \sin n \pi x$	
$\frac{\text{by } \mathcal{U}(x,t) = \sum_{n=1}^{\infty} b_n \sin n x}{n+1} e^{\frac{-C^2 K^2 n^2 t}{2}}$	
where by is determined from the equation	
$b_n = 2 \int_{-\infty}^{\infty} u_0(x) \sin \pi x  dx$	
l l	
80l.	²t 6
let u(x, t) = (A cos kx+B sinkx)e-Kc2	
be the general souloution of the heat	
$\partial u = c \partial^2 u - 0$	
$\frac{\partial u}{\partial t} = c \frac{\partial^2 u}{\partial x^2} - C$	
suice me ends (0=x, x=l) are cooled.	to e
O'c and hight at that temps throughout	-,
we have	
u(0,t) = u(l,t) = 0 for all t	2
$u(x,0) = u_0(x)$ is the initial condition -(	2)
From O 2. O,	
$Ae^{-K^2c^2t} = 0 \implies A = 0$	
and Bsin Kle-K <sup>2</sup> c <sup>2</sup> t = 0 => sin kl = 0	

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Hence, $u(xt) = bn sui n kx e^{-n^2 k^2 ct}$ on suplacing B by $bn$ The most general solution obtained by adding all such solutions for $n = 1, 2, 3$ $u(x,t) = \sum bn sin n kx e^{-n^2 k^2 c^2 t}$ $u(x,t) = \sum bn sin n kx = uo(x)$ $u(x,0) = \sum bn sin n kx = uo(x)$ $bn = 2 \int b(x) sin n kx dx$ $e \int bn = 2 \int b(x) sin n kx dx$ $e \int bn = 2 \int b(x) sin n kx dx$ $e \int bn = 2 \int bn sin n kx dx$ $e \int bn = 2 \int bn sin n kx dx$ $e \int bn = 2 \int bn sin n kx dx$	0	Date
Here, $u(xt) = bn sui n kx e^{-n^2 k^2 ct}$ on suplacing B by $bn$ The most general solution you $n = 1, 2, 3$ all such solutions you $n = 1, 2, 3$ $n = 1$	30	
Hence, $u(xt) = bn sui n kx e^{-n^2 k^2 ct}$ on suplacing B by $bn$ The most general solution obtained by adding all such solutions for $n = 1, 2, 3$ $u(x,t) = \sum bn sin n kx e^{-n^2 k^2 c^2 t}$ $u(x,t) = \sum bn sin n kx = uo(x)$ $u(x,0) = \sum bn sin n kx = uo(x)$ $bn = 2 \int b(x) sin n kx dx$ $e \int bn = 2 \int b(x) sin n kx dx$ $e \int bn = 2 \int b(x) sin n kx dx$ $e \int bn = 2 \int bn sin n kx dx$ $e \int bn = 2 \int bn sin n kx dx$ $e \int bn = 2 \int bn sin n kx dx$	10.	08 hl=nx or k=nx
The most general solv is obtained by adding all such solutions for $n = 1, 2, 3$ 1. In, t) = $\sum_{n=1}^{\infty} b_n s_n^2 n \times n $	No.	
me nost general solv is obtained by adding all such solutions for $n = 1, 2, 3$ in $(x,t) = \sum_{n=1}^{\infty} b_n s_n^2 n \times n + \sum_{n=1}^{\infty} c_n^2 + \sum_{n=1}^{\infty} c_n$	Took	Here, u(x,t) = bu sui nxx e e2.
The most general solv is obtained by adding all such solutions for $n = 1, 2, 3$ all such solutions for $n = 1, 2, 3$ by $\frac{-n^2 \pi^2 c^2 t}{c^2 t}$ $\frac{1}{n} = 1$ $1$		on replacing B by Bu
$u(x,t) = \sum_{n=1}^{\infty} b_n s_n^n n \times x \in e^2 - 3$ $u(x,0) = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $c_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$		
$u(x,t) = \sum_{n=1}^{\infty} b_n s_n^n n \times x \in e^2 - 3$ $u(x,0) = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $b_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$ $c_n = \sum_{n=1}^{\infty} b_n s_n^n n \times x = u_0(x)$	1	The most general soir is obstained by adding
$u(x,t) = \sum_{n=1}^{\infty} b_n sinn K \chi e^{-\frac{n^2 K^2 c^2 t}{2}} - 3$ $t = 0 \text{ in } (3) \text{ then}$ $u(x,0) = \sum_{n=1}^{\infty} b_n sin n K \chi = uo(x)$ $b_n = \sum_{n=1}^{\infty} b_n sin n K \chi = uo(x)$ $b_n = \sum_{n=1}^{\infty} b_n sin n K \chi = uo(x)$ $b_n = \sum_{n=1}^{\infty} b_n sin n K \chi = uo(x)$ $b_n = \sum_{n=1}^{\infty} b_n sin n K \chi = uo(x)$ $b_n = \sum_{n=1}^{\infty} b_n sin n K \chi = uo(x)$ $b_n = \sum_{n=1}^{\infty} b_n sin n K \chi = uo(x)$ $b_n = \sum_{n=1}^{\infty} b_n sin n K \chi = uo(x)$ $b_n = \sum_{n=1}^{\infty} u_n k \chi = uo(x)$ $b_n = \sum_{n=1}^{\infty} u_n k \chi = uo(x)$ $c_n = \sum_{n=1}^{\infty} u_n k \chi = uo(x)$		all such solutions you n = 1, 2, 5
t=0 m² (3) then  u(x,0) = \( \) bn \( \) \		$\frac{-u^2 \wedge^2 c^2 t}{\sqrt{2}}$
t=0 m² (3) then  u(x,0) = \( \) bn \( \) \	2	u(x,t) = 2 6 u s (u + v + v + v + v + v + v + v + v + v +
Dues 2. The initial temp of an insulated infinite rod is given by $u(x,0) = (-1)^n u$	3	
bn = 2 (Mo(x) sin n x x dx e ) lus 2. The initial temp of an insulated infinite rod is given by $M(x,0) = (-1)^m U$	3	t = 0 m (3) then
bn = 2 (Mo(x) sin n x x dx e ) lus 2. The initial temp of an insulated infinite rod is given by $M(x,0) = (-1)^m U$	-0-	11 (XID) - S bu Sin N KX = UD(N)
Dues 2. The initial temp of an insulated infinite rod is given by $u(x,0) = (-1)^m U$	0	$\frac{\mathcal{L}(\mathcal{L}(0)) - 2 \mathcal{L}(0)}{Q}$
Dues 2. The initial temp of an insulated infinite rod is given by $u(x,0) = (-1)^n U$	0	bn = 2 ( Up (XX) Sin n Fx da
Dues 2. The initial temp of an insulated infinite rod is given by u(x,0) = (-1) U	9	e ) e
infinite rod is given by u(x,0) = (-1) U	2	
infinite rod is given by u(x,0) = (-1) U	3	Ques 2. The initial temp of an insulated
between x = n c and x=1 (n+1)e, where	3	infinite rod is given by u(x,0) = (-1) U
, , , , , , , , , , , , , , , , , , , ,	3	between x=nc and x=l(n+1)e; where
n EI. Show mat for t = 0d^2(2m+1)^2 x^2 t^2	-9	n EI. Show mat for t = 0d^2(2m+1)^2 x^2 t^2
$n \in I$ . Show that for $t = 0$ . $d^{2}(2m+1)^{2}R^{2}t^{2}$ $u(n,t) = 4U = 1$ Sin $S(2m+1) \times X^{2}e^{-C^{2}}$ $N = 0 \times 2m+1$ a $S(2m+1) \times X^{2}e^{-C^{2}}$	_9_	u(n,t) = 40 5 1 3ins(2m+1) 1x4 e c2
	9	
30l Juital temp is alternatively v and -V	2	
over equal distances on tre infrite	9	
2 rod. Hence the final rod at t= 00 will	2	
se tre arreage of anymie t will be an	2	add beside to anything to the se an
period 2c. It will satisfy the	2	besid 20 At will he had
conditions:		conditions:
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i x1 = 0 at x1 = 0 2 ii) u = 0 at x1 = C	0/
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Let the general solution of the heat equal	6
Let me general solution of the heat eq." $\frac{\partial u}{\partial t} = t^2 \frac{\partial^2 u}{\partial x^2}$ be $u(x,t) = A \cos kx + B \sin kx \in -2$	6
Applying conditions O & O me have,	6
$\frac{2}{\sqrt{2}} d^2 +$	e
$\frac{1}{\text{Ulx}_{1}t} = \sum_{n=1}^{\infty} B_{n} \sin \frac{n\pi d^{2}t}{C}$	0
	0
This is an odd for of x with period 2c. since u(x,0) = 0 for 0 <x<c -="" 3<="" td=""><td>6</td></x<c>	6
	C
gives. $U = \sum_{\alpha} B_{\alpha} Su^{\alpha} \frac{M \pi \chi}{C}$	C-
	6
Bn = 2 CV sui n Txdn	6
$= 2u \left[ -C \cos n \pi x \right]^{C}$	•
$= 2U \left(1 - \cos n\pi\right) = 4U \left(\text{when n is odd}\right)$	6
= 0 (when h is even)	0
Let- n-2m+1, So that	
$B_n = 4U$	
$\frac{(2m+1)}{(2m+1)} = \frac{4}{(2m+1)}$	
Man Publica Dia al O la Cata	-
Now putting the value of Bn from (4)	9
	0
$U(\chi_1 t) = 4U \sum_{m=0}^{\infty} \frac{1}{2m+1} \sum_{m=0}^{\infty} \frac{(2m+1)^2 d^2 \chi^2 t}{C}$	
T m=0 2m+1 C	0
	9
	-0

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