B.Tech. SEM -IV (Civil) 2014 Course (CBCS) : WINTER - 2018

SUBJECT : ENGINEERING MATHEMATICS – III

Day : Tuesday
Date : 13/11/2018

W-2018-2332

Time : 02.30 PM TO 05.30 PM
Max. Marks : 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.

Q.1 **a)** Solve by variation of parameters method: $\left(D^2-1\right)y = e^{-x}\sin\left(e^{-x}\right)+\cos\left(e^{-x}\right)$. **[05]**

b) Solve : $\frac{dx}{2x} = \frac{dy}{-y} = \frac{dz}{4xy^2-2z}$. **[05]**

OR

a) Solve : $\left(D^2+5D+6\right)y = e^{-2x}\sec^2 x\left(1+2\tan x\right)$. **[05]**

b) Solve : $(2x+3)^2\frac{d^2y}{dx^2} - 2(2x+3)\frac{dy}{dx} - 12y = 6x$. **[05]**

Q.2 A light horizontal strut AB of length l is freely pinned at A and B and is under the action of equal and opposite compressive forces P at each of its ends and carries load W at its centre. Prove that the deflection at the centre is $\frac{W}{2P}\left(\frac{1}{n}\tan\frac{nl}{2} - \frac{l}{2}\right)$ where $n^2 = \frac{P}{EI}$. **[10]**

OR

A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially in a position given by $y(x,0) = y_0\sin^3\left(\frac{\pi x}{l}\right)$. If it is released from rest from this position, find the displacement y at any distance x from one end at any time t. **[10]**

Q.3 Solve the following system by Cholesky's method: **[10]**

$4x_1 + 6x_2 + 8x_3 = 0$

$6x_1 + 34x_2 + 52x_3 = -160$

$8x_1 + 52x_2 + 129x_3 = -452$

OR

Apply Runge Kutta fourth order method to find an approximate value of y when $x = 0.2$, given that $\frac{dy}{dx} = \frac{y^2-2x}{y^2+2x}$ and $y = 1$ when $x = 0$. Take h=0.1 **[10]**

P.T.O.

Q.4 Calculate the regression equation of x on y and y on x from the following data and estimate x when $y = 26$ and estimate y when $x = 21$. **[10]**

x_i	10	12	13	17	18	20	24	30
y_i	5	6	7	9	13	15	20	21

OR

a) An urn contains 6 white and 8 red balls, second urn contains 9 white and 10 red balls. One ball is drawn at random from the first urn and put it into the second urn without noticing its colour. A ball is then drawn at random from the second urn. What is the probability that it is red? **[05]**

b) Assume that probability of an individual coal miner being killed in a mine accident during a year is $\frac{1}{2400}$. Calculate the probability that in mine employing 200 miners there will be atleast one will killed by accident in a year. **[05]**

Q.5 **a)** For solenoidal field $\overline{E}$, show that curlculrcurlcurl $\overline{E} = \nabla^4 \overline{E}$. **[05]**

b) Find the directional derivative of $\phi = xy^2 + yz^3$ at (1, -1, 1) along the direction normal to the surface $x^2 + y^2 + z^2 = 9$ at (1, 2, 2). **[05]**

OR

Prove that : **[10]**

i) $\nabla^2 f(r) = \frac{d^2 f}{dr^2} + \frac{2}{r}\frac{df}{dr}$.

ii) $\nabla^4 e^r = e^r + \frac{4}{r} e^r$.

Q.6 Verify the divergence theorem for $\overline{F} = (x + y^2)\hat{i} - 2x\,\hat{j} + 2yz\hat{k}$ over the volume of a tetrahedron bounded by co-ordinate planes and the plane $2x + y + 2z = 6$. **[10]**

OR

Verify Stokes theorem for $\overline{F} = xy^2\hat{i} + y\hat{j} + z^2 x\hat{k}$ for the surface of a rectangular lamina bounded by $x = 0, y = 0, x = 1, y = 2, z = 0$. **[10]**

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