Seat No.	

Total No. of Pages : 4

S.E. (Civil) (Part - II) (Semester - III) Examination, December - 2014
ENGINEERING MATHEMATICS - III
Sub. Code : 42654

Day and Date : Friday, 05 - 12 - 2014
Time : 10.00 a.m. to 01.00 p.m.

Total Marks : 100

Instructions :
1) Attempt any three questions from each section.
2) Figures to right indicate full marks.
3) Use of non programmable calculator is allowed.
4) Use one answer book for both the sections.

SECTION - I

Q1) Solve :

a) $(D^2 - 5D + 6)y = e^x \cos 2x$. **[6]**

b) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x \sin x$. **[5]**

c) $x^2 \frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^4$. **[6]**

Q2) The differential equation satisfied by a beam uniformly loaded (W kg/meter), with one end fixed and the second end subjected to tensile force P, is given by **[16]**

$$E.I.\frac{d^2y}{dx^2} = Py - \frac{1}{2}Wx^2.$$

P.T.O

Show that the elastic curve for the beam with conditions $y = 0 = \frac{dy}{dx}$ at $x = 0$ is given by

$$y = \frac{W}{Pn^2}(1 - \cosh nx) + \frac{Wx^2}{2P} \text{ where } n^2 = \frac{P}{E.I}$$

Q3) Solve :

a) $y^2 p - xyq = x(z - 2y)$ **[6]**

b) $p^2 + q^2 = z^2(x + y)$ **[6]**

c) $p(1 + q^2) = q(z - a)$ **[5]**

Q4) a) Given that $f(x) = x + x^2$ for $-\pi < x < \pi$, find the Fourier expansion of $f(x)$ and hence deduce that $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \text{---------------}$ **[9]**

b) Obtain half range sine series for **[7]**

$$f(x) = \begin{cases} x & ; 0 \le x \le a \\ a & ; a \le x \le \pi - a \\ \pi - x & ; \pi - a \le x \le \pi \end{cases}$$

SECTION - II

Q5) a) Record of test of intelligence ratio (I.R.) and engineering skills (E.S.) of 10 students are given in the following table. Calculate coefficient of correlation. **[5]**

Student	A	B	C	D	E	F	G	H	I	J
I.R. (x)	105	104	102	101	100	99	98	96	93	92
E.S (y)	101	103	100	98	95	96	104	92	97	94

b) In a partially destroyed laboratory record, only the lines of regression of y on x and x on y are available as $4x-5y+33=0$ and $20x-9y=107$ respectively. Calculate $\overline{x}, \overline{y}$ and the coefficient of correlation between x and y. **[5]**

c) Fit a second degree parabola $y = a + bx + cx^2$ to the following data: **[6]**

x	-3	-2	-1	0	1	2	3
y	4.63	2.11	0.67	0.09	0.63	2.15	4.58

Q6) a) A random variable x has the following probability distributions. **[6]**

x	0	1	2	3	4	5	6	7	8
$p(x)$	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

Determine :

i) The value of a,

ii) $p(x<3), p(x>3), p(0<x\leq 5)$.

b) The probability that a bomb dropped from a plane will strike the target is 1/5. If six bombs are dropped, find the probability that **[5]**

i) Exactly two will strike the target,

ii) At least two will strike the target.

c) Between 2 and 4 P. M. the average of phone calls per minute coming into the switch board of a company is 2.5. Use Poisson distribution to find the probability that during one particular minute there will be **[6]**

i) Non phone call at all,

ii) Exactly 3 calls.

Q7) a) Find the directional derivative of $f(x,y) = xy^2 + yz^2$ at the point (2, -1, 1) along the normal to the surface $xy + yz + zx = 3$ at the point (1, 1, 1). **[5]**

b) If $\overline{r} = xi + yj + zk$ with $r = |\overline{r}|$ and $\overline{a}$ is a constant vector, prove that

$$\nabla \times \left(\frac{\overline{a} \times \overline{r}}{r^n} \right) = \frac{(2-n)}{r^n}\overline{a} + \frac{n(\overline{a}.\overline{r})}{r^{n+2}}\overline{r}.$$ **[6]**

c) Show that the vector field defined by

$\overline{F} = (y\sin z - \sin x)i + (x\sin z + 2yz)j + (xy\cos z + y^2)k$ is irrotational and find its scalar potential. **[6]**

Q8) a) Verify Green's theorem for $\int_C [(3x - 8y^2)dx + (4y - 6xy)dy]$ where C is the boundary of the region bounded by $x = 0$, $y = 0$ and $x + y = 1$. **[8]**

b) Use the Stoke's theorem to evaluate

$\int_C [(x+2y)dx + (x-z)dy + (y-z)dz]$ where C is boundary of the triangle with vertices (2, 0, 0), (0, 3, 0) and (0, 0, 6) oriented in the anti -clockwise direction. **[8]**

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