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SUBJECT CODE NO: E-196
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(ALL) (CGPA) Examination Nov/Dec 2017
Engineering Mathematics - III
(REVISED)

[Time: Three Hours]

[Max.Marks:80]

- N.B
- Please check whether you have got the right question paper.
- i) Q. No.1 from Section A and Q.No.6 from Section B are compulsory.
 - ii) Solve any two questions from remaining of each section.
 - iii) Figures to the right indicate full marks.
 - iv) Assume suitable data, if necessary.

Section A

- Q.1 Solve any five from the following. 10
- a) Solve $(D^3 - 3D + 2)y = 0$.
 - b) Solve $(D^4 - 1)y = 0$
 - c) Find the particular integral of $(D^2 - D - 6)y = e^{3x} + e^{-2x}$.
 - d) Find the particular integral of $(D^3 + 2D^2 + 4D + 8)y = x$.
 - e) The charge Q of a condenser of capacity C is discharged in a circuit of resistance R and self-inductance L. Find the differential equation of the circuit.
 - f) A column of length 'l' is fixed at one end in completely free at other. The load 'p' is axially applied at the free end, the origin is taken at the fixed end and 'a' is the lateral displacement of the free end, its deflection is given by_____.
 - g)) Find he Fourier transform of
$$f(x) = \begin{cases} 1; & 0 < x < a \\ 0; & \text{otherwise} \end{cases}$$
 - h) Find the Fourier cosine transform of
$$f(x) = \begin{cases} x; & 0 < x < 1 \\ 0; & x > 1 \end{cases}$$

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- Q.2
- Solve $(D^3 + 1)y = \cos(2x - 1)$. 05
 - An emf $e = 200 e^{-5t}$ is applied to a series circuit of 20 ohm resistor and 0.01F capacitor. Find the charge and current at any time assuming that there is no initial charge on capacitor. 05
 - Find the Fourier cosine and sine transform of 05

$$f(x) = \begin{cases} x; & 0 < x < 1 \\ 2 - x; & 1 < x < 2 \\ 0; & x > 2. \end{cases}$$

- Q.3
- Solve $D^2 - 4D + 4)y = 8x^2 e^{2x} \sin 2x$ 05
 - The deflection of a strut of length l with one end ($x = 0$) built in and the other supported and subjected to end thrust P , satisfies the equation $\frac{d^2 y}{dx^2} + a^2 y = \frac{a^2 R}{p} (l - x)$. Prove that the deflection curve is $y = \frac{R}{P} \left(\frac{\sin ax}{a} - l \cos ax + l - x \right)$, where $al = \tan al$. 05
 - Express the function $f(x) = \begin{cases} 1; & |x| \leq 1 \\ 0; & |x| > 1 \end{cases}$ as a Fourier integral. Hence evaluate $\int_0^\infty \frac{\sin \lambda \cos \lambda x}{\lambda} d\lambda$. 05

- Q.4
- Solve $x^2 \frac{d^3 y}{dx^3} + 3x \frac{d^2 y}{dx^2} + \frac{dy}{dx} = x^2 \log x$. 05
 - A mass 40 kg is attached to a spring for which $k = 640 N/m$ brought to rest. Find the position of the mass at time t if a force equal to $10 \sin 2t$ is applied to it 05
 - Find $f(x)$ if its Fourier sine transform is $\frac{\omega}{\omega^2 + 1}$. 05

- Q.5
- Solve by method of variation of parameter $\frac{d^2 y}{dx^2} - y = \frac{2}{1 + e^x}$ 05
 - Solve without variation of parameter $(D^2 + 3D + 2)y = \cos(e^x)$. 05
 - Solve for $f(x)$ from the integral equation $\int_0^\infty f(x) \cos sx dx = e^{-s}$. 05

Section B

- Q.6 Solve any five from the following 10

- a) Find the mean from the following data

Mark below	10	20	30	40	50	60	70	80	90	100
No. of Student	5	9	17	29	45	60	70	78	83	85

- b) In what direction for the point $(3, 1, -2)$ directional derivative of $\phi = x^2 y^2 z^4$ maximum

- c) State Stoke's theorem
- d) Find $\text{grad } \phi$, if $\phi = 2x^3 y^2 z^4$ at point (1,2,3).
- e) Find the area under the normal curve between $z = -1.23$ to $z = 2.13$.
- f) Show that $\vec{F} = (y^2 + 2xz^2)i + (2xy - z)j + (2x^2z - y + 2z)k$ is irrotational.
- g) The probability of evening college students will graduate is 0.3. Determine the probability that out of five students at least one will graduate.
- h) Coefficient of Quartile Deviation = _____.

Q.7 a) Find the Karl – Pearson Co efficient of skewness for the following data 05

Marks	0-5	5-10	10-15	15-20	20-25	25-30
No. of Students	4	6	8	12	7	2

- b) Prove that $\nabla \cdot \left(r \nabla \frac{1}{r^n} \right) = \frac{n(n-2)}{r^{n+1}}$ 05
- c) Evaluate $\int_c \vec{F} \cdot d\vec{r}$, Where $\vec{F} = zi + xj + yk$ and c is the arc of the curve $\vec{r} = \cos t i + \sin t j + tk$ from $t = 0$ to $t = 2\pi$. 05

Q.8 a) The mean I.Q. of large number of children of age 14 is 100 with standard deviation 16. Assuming the distribution of I.Q. to be normal, find the percentage of children having I.Q. between 70 to 120. 05

- b) Evaluate $\oint_c [x^2 - \cosh y) dx + (y + \sin x) dy]$, where c is the rectangle with vertices (0,0), $(\pi, 0)$, $(\pi, 1)$ and $(0,1)$ using Green's theorem. 05
- c) Find coefficients of correlation of the following data 05

X	3.5	5.0	7.0	10	12	15	18
Y	241	318	174	110	147	122	86

- Q.9 a) Verify Stoke's theorem for $\vec{F} = yi + zj + xk$ over the surface $x^2 + y^2 = 1 - z$, $z > 0$ 05
- b) Find the directional derivative of $\phi = x^2y + yz^2$ at $(2, -1, 1)$ in the direction normal to the surface $x^2y + y^2x + yz^2 = 3$ at $(1,1,1)$. 05
- c) According to past record of one day international between India and Pakistan, Indian has won 15 matches and lost 10. If they decide to play a series of 6 matches now, what is the probability of India winning the series. 05

Q.10

a) Determine the equation of regression line X on Y of the following data

X	14	18	23	30	50
Y	900	1200	1600	2100	3800

b) Prove that $\iint_s \frac{ds}{\sqrt{a^2x^2 + b^2y^2 + c^2z^2}} = \frac{4\pi}{\sqrt{abc}}$,

where is the ellipsoid $a^2x^2 + b^2y^2 + c^2z^2 = 1$

c) Prove that $\vec{F} = (3x + 4y^2z)i + (x^3 \sin z - 3y)j - (e^x + 4 \cos x^2 y)k$ is solenoidal but not irrotational.