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Punjab Engineering College (Deemed to be University), Chandigarh

Mid Term Examination

Programme : B.E 1st year
Course Name : Mathematics I
Maximum Marks : 25

Year/Semester : 18191
Course Code : MAN 101
Time Allowed : 1Hour 30 Min

- All questions are compulsory. Each question carries 5 marks.
- Unless stated otherwise, the symbols have their usual meanings in context with subject.

Ques.		Marks
Q 1.	Check the behaviour of the following series : (i) $\sum_{n=1}^{\infty} \frac{(-1)^n\ (2n)!}{2^n\ n!\ n!}$ (ii) $\sum_{n=2}^{\infty} \frac{\log n}{\sqrt{n}}$	3 2
Q2.	Find the interval of convergence of the series $\sum_{n=0}^{\infty} \frac{(x-1)^{2n}}{4^n}$. For what values of x does the series converge absolutely/conditionally?	4
Q3.	(a) Show that if we substitute polar coordinate $x = r\cos\theta$ and $y = r\sin\theta$ in a differentiable function $w = f(x,y)$, then $\frac{\partial w}{\partial r} = f_x \cos\theta + f_y \sin\theta$ and $\frac{1}{r}\frac{\partial w}{\partial \theta} = -f_x \sin\theta + f_y \cos\theta$ (b) Solve the equations in (a) to express f_x *and* f_y in terms of $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial \theta}$. (c) Show that $f_x^{\ 2} + f_y^{\ 2} = (\frac{\partial w}{\partial r})^2 + \frac{1}{r^2}(\frac{\partial w}{\partial \theta})^2$	4
Q4.	(a) Let $U = f(P,V,T)$ be the internal energy of a gas that obeys the ideal gas law $PV = nRT$ (n and R are constants), find : (i) $\left(\frac{\partial U}{\partial P}\right)_V$ (ii) $\left(\frac{\partial U}{\partial T}\right)_V$ (b) Suppose T is to be found from the formula $T = x(e^y + e^{-y})$ where x and y are found to be 2 and log 2 with maximum possible errors of $\lvert dx\rvert = 0.1$ and $\lvert dy\rvert = 0.02$. Estimate the maximum possible error in the computed value of T.	2 2
Q5.	(a) Find $\lim_{(x,y)\to(0,0)} \frac{xy}{\lvert xy\rvert}$, if it exists. (b) Find the local extreme values of the function $f = xy - x^2 - y^2 - 2x - 2y + 4$	2 2
Q6.	Find the absolute maxima and minima of $f(x,y) = x^2 + xy + y^2 - 6x + 2$ on the rectangular plate $0 \le x \le 5$, $-3 \le y \le 0$.	4

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PUNJAB ENGINEERING COLLEGE (DEEMED TO BE UNIVERSITY), CHANDIGARH

End-Term Examination

Programme: B.E (Common to all branches)
Course Name: Mathematics- I
Maximum Marks: 40

Year/Semester: 2018/18191
Course Code: MAN 101
Time allowed: 3 Hours

NOTE:

- All questions are compulsory
- The candidates before starting to write the solutions, should check the question paper for any discrepancy and also ensure that they have been delivered the question paper of right course code.

S No.	Questions	Marks
Q1	Check whether the following series is convergent or divergent. Give reasons in support of your answer. $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{\log n}{n}$	3
Q2	Find the radius and interval of convergence of the series, $\sum_{n=0}^{\infty} n!\,(x-4)^n$ For what value of x the series converges (i) absolutely (ii) conditionally?	3
Q3	Find the first four non-zero terms of the Taylor's series generated by $f(x) = \sqrt{x+4}$ at a = 0	3
Q4	Show that if $w = f(u,v)$ satisfies the Laplace equation $f_{uu} + f_{vv} = 0$ and if $u = \frac{x^2-y^2}{2}$ and $v = xy$, then w satisfies the Laplace equation, $w_{xx} + w_{yy} = 0$	3
Q5	Evaluate $\lim_{(x,y)\to(1,1)} \frac{x^3y^3-1}{xy-1}$	2
Q6	Find the Absolute Maxima and Absolute Minima of the function $f(x,y) = x^2 - xy + y^2 + 1$ on the closed triangular plate in the first quadrant bounded by the lines $y = x, x = 0, y = 4$	3
Q7	Let R be the region in the first quadrant of the xy- plane bounded by the hyperbolas $xy = 1, xy = 9$ and the lines $y = x, y = 4x$. Use the transformation $x = \frac{u}{v}, y = uv$ with $u > 0,\ v > 0$ to evaluate the integral in the uv-plane, $\int\int_R\left(\sqrt{\frac{y}{x}} + \sqrt{xy}\right)dxdy$	3
Q8	Find the surface area of the curve generated by revolving the region about x-axis. $x = \frac{y^4}{4} + \frac{1}{8y^2}$; $1 \le y \le 2$	3
Q9	Evaluate $\int_0^2\int_0^{\sqrt{1-(x-1)^2}} \frac{x+y}{x^2+y^2}\,dydx$	3
Q10	Find the volume of the region in the first octant bounded by the coordinate planes, the plane $y = 1 - x$ and the surface $z = \cos\left(\frac{\pi x}{2}\right)$, $0 \le x \le 1$.	3
Q11	Solve the differential equation $(x^4 + y^2)dx - xydy = 0$; $y(2) = 1$	3
Q12	Find the general solution of the differential equation by the methods of variation of parameter $(x^2D^2 - 2xD + 2)y = x^3 \sin x$	3
Q13	Solve the initial value problem $3y'' - 8y' - 3y = 0$; $y(-3) = 1$, $y(3) = \frac{1}{e^2}$	3
Q14	Identify and sketch the surface represented by $\frac{x^2}{4} + \frac{y^2}{9} = z$	2

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