Date- 12/10/15 FYBSC Physics-I

Regular

VCD 12/10/15 F.Y. B.Sc. PHYSICS-I I-SEMESTER 2015-16 75 MARKS 2.30 HRS.

Note: i) All the questions are compulsory.

ii) Figures to the right indicate full marks.

iii) Use of non-programmable calculator is allowed.

Q.1) A) Attempt any one. [8M]

a) If A = i-2j-3k, B=2i+j-k & C = i+3j-2k.

Find (i) | (A X B) X C| (ii) (A X B) X (BX C) (iii) (A X B) .C (iv) |A X (B X C) |

b) If $A=2yz\,i-x^2yj+xz^2k$, $B=x^2i+yzj-xyk$ & $\emptyset = 2x^2yz^3$.

Find (i) $(A.\nabla)\emptyset$ (ii) $A.\nabla\,\emptyset$ (iii) $(B.\nabla).A$ (iv) $(A\times\nabla)\emptyset$.

Q.1) B) Attempt any one. [7M]

a) Find $\nabla \times A$ at point (1,-1,1). If $A = xz^3\,i-2x^2yz\,j+2yz^4\,k$.

b) Show that the addition of vectors is associative. i.e. A+ (B+C) = (A + B)+ C.

Q.1) C) Attempt any one. [5M]

a) If A= 2i+7j+2k and B= 3i-j+-2k, find (i) A.B (ii) |A.B| (iii) (2A+3B)

b) Prove that $\nabla(F.G) = G\nabla F + F\nabla G$

Q2 A) Attempt any one. [7M]

a) Solve the equation is exact and hence find its solution.

$$(x^2+\ln y)\,dx + \frac{x}{y}dy = 0$$

b) Solve the equation $\frac{dy}{dx} + \frac{2}{x}y = \frac{x^2}{2}$

Q2 B) Attempt any one. [8M]

a) The emf equation for the charging of a capacitor circuit is $R(dq/dt)+q/c=E$ Derive the expression for the charge on the capacitor. The initial charge on capacitor is zero.

b) A body starts from rest and tall under gravity in a resistive medium. If we assume that the resistive force is proportional to the velocity its equation of motion is $(\frac{dv}{dt})+bv = g$. Solve the equation for v.

Q2 C) Attempt any one. [5M]

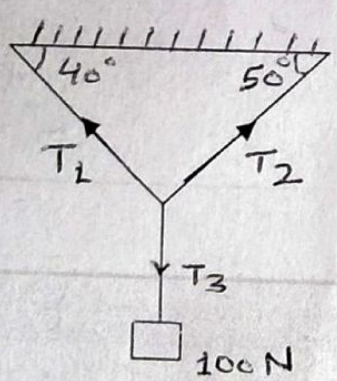
a) Show that $y=e^x+e^{2x}$ is a solution of $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} +2y=0$

b) $\ln y = - x (\ln x - 1)$ is solution of $\frac{dy}{dx} + \ln x^y =0$

Q3) A) Attempt any one [8M}

a) Derive Bernoulli's equation. What principle is it based? Is it equation applicable for a real liquid flow?

b) A weight of 100N hangs from a string tied to the two other strings attached to a fixed support as shown in figure below . The two strings make angles of 40° and 50° with the horizontal. Find the tensions in all three strings.



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Q3) B) Attempt any one. [7M]

a) For a homogeneous isotopic material show that $\sigma = \frac{3K-2\eta}{6K+2\eta}$.

b) The velocity above and below the wings of an airplane are v_1 and v_2 respectively and A is the area of the wings show that the upward force is $\frac{1}{2} A (v_1^2 - v_2^2)\rho$, Where ρ is the density of air.

Q3) C) Attempt any one [5M]

a) A thin metal plate of 10 cm^2 in area rests on a layer of oil 2mm thick A force of 0.01N applied to the plate horizontally keep it moving with a uniform speed of 1cm/find the viscosity of the oil.

b) For a steel material, $Y=2\times10^{11}$ N/m^2 and Bulk modulus is 13.3×10^{10} N/m^2, calculate Poisson's ratio and modulus of rigidity of steel.

Q.4) Attempt any three. [15M]

a) (i) define scalar & vector.

(ii)Classify the following in scalar & vectors.

Charge, Kinetic Energy, Entropy, Frequency, Force, Magnetic field.

b) Prove that $(y^2-z^2+3yz)\,\hat{i} + (3xz+2xy)\,\hat{j} + (3xz+2xz+2z)\,\hat{k}$ is solenoid.

c) Show that the function F(x,y) , $F(x, y)= x^4+3x^2y+xy^2$ dF is a perfect differential?

d) Solve the equation $\frac{d^2y}{dx^2} + w^2y = 0$

e) Determine the force per unit area required to compress a volume of water by one percent. (Bulk modulus of water is 5×10^{10} dynes/cm^2)

f) A thin metal plate of 20 cm^2 in area rests on a layer of oil 3mm thick A force of 0.01N applied to the plate horizontally keep it moving with a uniform speed of 2cm/s.Find the viscosity of the oil.