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| **Qns** | **Answer** | **Marks** |
| 1 (a) | … a wave whose profile remains static | 1 |
| (b) | (i) The equation is of the form y = a sin  ∴ = 5  ∴λ = **0.2 m** | 1  1 |
| (ii) Now, f = 12 Hz  and v = fλ = 12 x 0.2 = **2.4 m s‑1** | 1  1 |
| (c) | y1 = 0.2 sin 2π(12t -5x)  and y2 = 0.2 sin 2π(12t + 5x) the reflected ray  So y = y1 + y2  = 0.2 sin 2π(12t - 5x) + 0.2 sin 2π(12t + 5x)  = 0.4 sin 24πt cos 10πx  = A sin 24πt  where A = 0.4 cos 10πx = 0.4 cos  So, the amplitude of the resultant wave is not constant but depends on the distance, x, along the direction of the wave.  A is maximum when x = 0, λ, λ, etc. These are the antinodes.  A = 0 when x = , etc. These are nodes.  So the resultant is a stationary wave.  At an antinode the amplitude = 0.4 m | ½  ½  ½  ½  ½  ½  ½  ½  1 |
| (d) | (i) Beats means the periodic rise and fall of loudness that occur when two notes of slightly different frequencies but same amplitude are sounded together.  Doppler effect is the apparent change in the frequency of a wave motion when there is relative motion between the source and the observer. | 1  1 |
| (ii) Used:   * in measuring unknown frequencies   Any 2 @1   * to tune an instrument to a certain frequency * as intermediate frequency in radios, TVs, etc | 2 |
| (e) | S  Reflected  Direct from source  us  The observer receives two sounds of slightly different frequencies -  one is due to sound of slightly lower frequency arriving directly from the source which is receding,  and another reflected by the wall.  Since the source is approaching the wall, the frequency as received (and reflected) by the wall is of slightly higher frequency.  When the two sounds are received they form beats at the observer. | 1  ½  ½  ½  ½ |
| (ii) Apparent frequency of the direct sound, f′ =  Apparent frequency of the direct sound, f′′ =  Beat frequency, fb = f′′ - f′ =  =  ∴ f =  =  = **212.5 Hz** | 1½  1½ |
| ***Total = 20*** | | |
| 2 (a) | … that value of steady current which would dissipate heat at the same rate in a given resistor as the alternating current. | 1 |
| (b) | Suppose that at a certain instant the p.d across the capacitor is E= Vosinωt.  E = Vosinωt  C  Then, the charge Q = CE = CVosinωt.  The current flowing at the instant is the rate at which charge is accumulating on or leaving the capacitor.  i.e. I == ωCVocosωt ….. (1)  Equation (1) can also be written as  I = Iocosωt ……………………..(2)  where Io is the peak current.  i.e Io = ωCVo  Thus  But  ∴Ir.m.s = **2πfCV** | ½  1  ½  ½  ½  1 |
| (c) | (i) The direction of deflection of the coil of a moving-coil meter depends on the direction of current.  If an alternating current is passed through the coil, the point would simply oscillate at the frequency of the a.c.  So, no reading can be taken | 1  1  1 |
| (ii)  Control spring  Coil  Fixed soft iron rod  Movable soft iron rod  Zero adjustor  It consists of two parallel soft iron rods, one fixed and the other free to move, located inside a coil. The rods are parallel to the axis of the coil and the bottom end of the pointer is fixed onto the movable rod.  The current to be measured flows round the coil and magnetises the two soft iron rods with like poles side by side.  Since like poles repel, the soft iron rods repel each other with the result that the movable one moves away thereby turning the pointer fixed to it.  The pointer turns until the counter torque developed in the control spring is enough to stop it.  The repulsion force, and therefore the angle turned through by the pointer, depends on the current flowing in the coil (but not linearly). | ½  ½  ½  ½  1  1  ½  ½ |
| (d) | (i) Let θ be the phase angle  Then θ = tan-1 = tan-1 = tan-1  = tan-11.333 = **53.1o** | 1  1 |
| (ii) I = = **2.83 A** | 3 |
| (iii) Power is dissipated only in the pure resistance.  ∴ Power = I2R =  = **480 W** | 2 |
| ***Total = 20*** | | |