St Bonaventure College and High School
Subject : Physics NSS2
Teaching Schedule (2011-2012)

Duration :First term : 1/9/2011 – 16/1/2012
Second term: 17/1/2012 - 29/6/2012

SP = Scheduled number of period
AP = Actual number of period

Date	Topic	Focus/ Objective (Knowledge & Generic Skills Acquired)	SP	AP	Learning & teaching activities (including IT learning activities)	Homework /Test	Learning Resources	Civic Ed./ Values
5/9 – 14/9	**Mechanical work** **Gravitational potential energy (P.E.)** **Kinetic energy (K.E.)**	1. Interpret mechanical work as a way of energy transfer (CTS) 2. Define mechanical work done $W = Fs\cos\theta$ (NS) 3. Solve problems involving mechanical work (NS, PSS, SS) 4. State that gravitational potential energy is the energy possessed by an object due to its position under gravity (CTS) 5. Derive $P.E. = mgh$ (NS) 6. Solve problems involving gravitational potential energy (NS, PSS, SS) 7. State that kinetic energy is the energy possessed by an object due to its motion 8. Derive $K.E. = \frac{1}{2}mv^2$ (NS)	8		**Simulations :** Kinetic energy	Book 2 P.224 – 228 No.6, 7, 14, physics in articles Chapter Test (Ch 4)	Book 2 Ch 4.1-4.4 Student learning Center	To appreciate the efforts made by scientists to find alternative environmentally friendly energy sources

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	Law of conservation of energy in a closed system **Power**	9. Solve problems involving kinetic energy (NS, PSS) 10. State the law of conservation of energy (CTS) 11. Discuss the inter-conversion of P.E. and K.E. with consideration of energy loss (CTS, CMS) 12. Solve problems involving conservation of energy (NS, PSS, SS) 13. Define power as the rate of energy transfer (CTS) 14. Apply $P = W/t$ to solve problems (NS, PSS, SS)			**Experiment & Video:** Expt 4a - Energy changes in a simple pendulum Energy changes in Bungee jump Magic can **Simulations :** Energy changes in a rising/falling ball Energy changes in a simple pendulum Energy changes in motion on an inclined plane			
15/9 – 23/9	**Linear momentum** **Change in momentum and net force**	1. Realise momentum as a quantity of motion of an object and define momentum $p = mv$ (CTS) 2. Understand that a net force acting on an object for a period of time results a change in momentum (NS, CTS) 3. Interpret force as the rate of change of momentum (Newton's Second Law of motion) (NS, CTS)	8		**Simulations :** Impact of force **Video:** Expt 5a - Investigating the force of impact Snooker Expt 5c - Hard crash Expt 5d - Bouncy crash **Experiment :** Expt 5b - Sticky crash **Video and simulations :** Expt 5e - 'Explosion' of trolleys 'Newton's cradle'	Book 2 P.262 – 272 No.1, 6, 18, physics in articles Chapter Test (Ch 5)	Book 2 Ch5.1-5.2 Student learning Center SBC Physics Homepage	

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	Law of conservation of momentum	4. State the law of conservation of momentum and relate it to Newton's Third Law of motion (CTS) 5. Distinguish between elastic and inelastic collisions (CTS) 6. Solve problems involving momentum in one or <u>two</u> dimensions (NS, PSS, SS)			**Simulations :** Exploring collision Adding mass while moving Shedding mass while moving **Video :** Conservation of momentum Crumble zone Seat-belt tensioner Air bag			
26/9 – 4/10	**Projectile motion**	1. Describe the shape of the path taken by a projectile launched at an angle of projection 2. Understand the independence of horizontal and vertical motions 3. Solve problems involving projectile motion	8		**Video :** Expt 6a – 'Monkey and hunter' Analyzing the motion of a ball flying off a horizontal platform Bombing a target Barcelona 1992 Olympic Flame Throwing a javelin **Simulations :** 'Smart missile' Range and angle of projections	Book 2 P.299 – 300 No.1, 2, 5 Chapter Test (Ch 6)	Book 2 Ch6.1-6.2 Student learning Center SBC Physics Homepage	
3/10 – 21/10	**<u>Uniform circular motion</u>**	1. <u>Define angular velocity as the rate of change of angular displacement and relate it to linear velocity</u> (CTS) 2. <u>Derive centripetal acceleration = v^2/r</u> (NS, CTS) 3. <u>Realise the resultant force pointing towards the centre of uniform</u>	10		**Video :** Flying swing Expt 7a - Verifying the equation for the centripetal force Centripetal force and inertia Turning a corner and skidding Speed cycling A tilted aeroplane **Simulations :** Horizontal circular motion Overturning of car	Book 2 P.328 – 332 No.3, 9, 10, 11 Chapter Test (Ch 7)	Book 2 Ch7.1-7.2 Student learning Center SBC Physics Homepage	

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		circular motion (CTS) 4. Solve problems involving uniform circular motion (PSS,NS,SS)						
24/10 – 4/11	**Gravitation**	1. State Newton's law of universal gravitation $F = GMm/r^2$ (CTS) 2. Define gravitational field strength as force per unit mass 3. determine the gravitational field strength at a point above a planet (NS, CTS) 4. Determine the velocity of an object in a circular orbit (NS, CTS) 5. Solve problems involving gravitation (PSS, NS, SS)	12		**Simulations :** Jump, jump , jump Tides	Book 2 P.356 – 359 No.1, 2, 5, physics in articles Chapter Test (Ch 8)	Book 2 Ch8.1-8.2 Student learning Center SBC Physics Homepage	To appreciate the contributions of Galileo and Newton that revolutionized the scientific thinking of their time, to appreciate the roles of science and technology in the exploration of outer-space and the efforts of humankind in the quest to understand nature
7/11 – 15/11	**General gas law**	1. Realise the existence of gas pressure (CTS) 2. Verify Boyle's law (NS, CTS) 3. Determine pressure-temperature and volume-temperature relationships of a gas (NS, CTS) 4. Determine absolute zero by the extrapolation of pressure - temperature or volume - temperature relationships	8		**Video :** Collapsing can Expt 5a) Boyles's Law Growing marshmallow Expt 5b – Pressure - temperature relationship of a gas Expt 5c – Volume - temperature relationship of a gas Table tennis **Experiment:** Boyle's law **Simulations:**	Book 1 P.170 – 171 No.4, 9, 11 Chapter Test (Ch 5)	Book 1 Ch 5.1-5.2 Student learning Center SBC Physics Homepage	

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		5. Use kelvin as a unit of temperature (NS, PSS, CTS) 6. Combine the three relationships (*p-V*, *p-T* and *V-T*) of a gas to obtain the relationship pV/T= constant (NS, CTS) 7. Apply the general gas law *pV= nRT* to solve problems (NS, CTS)			Pressure law Charles' law			
16/11 – 23/11	**Kinetic theory**	1. Realise the random motion of molecules in a gas (CTS) 2. Realise the gas pressure resulted from molecular bombardment (CTS) 3. Interpret gas expansion in terms of molecular motion (CTS) 4. State the assumptions of the kinetic model of an ideal gas 5. Derive $pV = 1/3\ Nmc^2$ (CTS,NS) 6. Iterpret temperature of an ideal gas using $K.E._{average} = 3RT/2N_A$ 7. Realise the condition that at high temperature and low pressure a real gas behaves as an ideal gas 8. Solve problems involving kinetic theory (CTS, NS, PSS, SS)	8		**Video :** Expt 5d- Observing random motion of molecules Expt 5e- The three-dimensional kinetic theory model **Simulations :** Random motion of molecules Kinetic theory and gas laws		SBC Physics Homepage	

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24/11 – 30/11	**Nature of waves** **Wave motion and propagation**	1. Interpret wave motion in terms of oscillation 2. Realise waves as transmitting energy without transferring matter 3. Distinguish between transverse and longitudinal waves 4. Describe wave motion in terms of waveform, crest, trough, compression, rarefaction, wavefront, phase, displacement, amplitude, period, frequency, wavelength and wave speed 5. Present information on displacement-time and displacement-distance graphs for travelling waves 6. Determine factors affecting the speed of propagation of waves along stretched strings or springs 7. Apply $Tf = 1$ and $v = f\lambda$ to solve problems	6		**Experiment & Video :** Expt 5a - Transverse pulses and waves Expt 5b - Longitudinal pulses and waves Expt 5d - Wave speed along a stretched spring **Simulation :** Transverse wave Longitudinal wave Amplitude of transverse waves Wavelength of transverse waves Frequency of transverse waves Particle movement and wave motion	Book 3B P.36-40 No.4, 6, 10 Physics in articles Chapter Test (Ch 5)	Book 3B Ch5.1-5.3 Student learning Center	
1/12-7/12	**Reflection and refraction**	1. Realise the reflection of waves at a plane barrier/reflector/surface 2. Examine the condition for a phase change on reflection	6		**Experiment & Video :** Expt 6b - Reflection of water waves by straight barrier Expt 6c - Refraction of water waves			

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		3. Realise the refraction of waves across a plane boundary 4. Examine the change in wave speeds during refraction and define refractive index in terms of wave speeds 5. Draw wavefront diagrams to show reflection and refraction			**Simulation :** Reflection of water waves Reflection by a straight barrier Wave model and ray model Refraction of water waves Refraction across a straight interface			
8/12 – 3/1	**Revision**		4					
4/1 – 16/1	**First Term Examination**							
17/1 – 19/1	**Exam Evaluation**							
2/2 – 17/2	**Diffraction and interference**	1. Describe the diffraction of waves through a narrow gap and around a corner 2. Examine the effect of the width of slit on the degree of diffraction 3. Describe the superposition of two pulses 4. Realise the interference of waves 5. Distinguish between constructive and destructive interferences 6. Examine the interference of waves from two coherent sources	14		**Experiment & Video :** Expt 6d - Diffraction of water waves Expt 6e - Adding pulses Expt 6f - Interference of water waves Expt 6g - Stationary waves Expt 6h - Transverse stationary waves on an elastic string Stroboscope **Simulation :** Diffraction of water waves Diffraction of waves Adding pulses Interference of water waves Constructive and destructive interference Interference patterns Stationary waves	Book 3B P.96 – 100 No.3, 7, 9, Physics in articles Chapter Test (Ch 6)	Book 3B Ch6.1-6.5 Student learning Center SBC Physics Homepage	

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Date	Topic	Focus/ Objective (Knowledge & Generic Skills Acquired)	SP	AP	Learning & teaching activities (including IT learning activities)	Homework /Test	Learning Resources	Civic Ed./ Values
	Stationary wave (transverse waves only)	7. Determine the conditions for constructive and destructive interferences in terms of path difference 8. Draw wavefront diagrams to show diffraction and interference 9. Explain the formation of a stationary wave 10. Describe the characteristics of stationary waves						
21/2 – 29/2	**Wave nature of light**	1. Point out light as an example of transverse wave 2. Realise diffraction and interference as evidences for the wave nature of light 3. Examine the interference patterns in the Young's double slit experiment 4. Apply $\Delta y = \lambda D/a$ to solve problems 5. Examine the interference patterns in the plane transmission grating 6. Apply $d\sin\theta = n\lambda$ to solve problems	8		**Experiment & Video :** Expt 7a - Diffraction of light Expt 7b - Interference of light Expt 7c - Plane transmission grating **Simulation :** Diffraction pattern of light Interference pattern of light Properties of electromagnetic waves	Book 3B P.135 – 139 No.3, 4, 12, Physics in articles 3	Book 3B Ch7.1-7.3 Student learning Center	To be aware that science has its limitations and cannot always provide clear-cut solutions; the advancement of science also requires perseverance, openness and skepticism, as demonstrated in the different interpretations on the nature of light in the history of physics over the past centuries

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1/3 – 9/3	**Wave nature of sound** **Audible frequency range** **Musical notes** **Noise**	1. Realise sound as an example of longitudinal waves 2. Realise that sound can exhibit reflection, refraction, diffraction and interference 3. Realise the need for a medium for sound transmission 4. Compare the general properties of sound waves and those of light waves 5. Determine the audible frequency range 6. Examine the existence of ultrasound beyond the audible frequency range 7. Compare musical notes using pitch, loudness and quality 8. Relate frequency and amplitude with the pitch and loudness of a note respectively 9. Represent sound intensity level using the unit decibel 10. Discuss the effects of noise pollution and the importance of acoustic protection	8		**Demonstration & video :** Expt 8a - The longitudinal wave model Chirping ruler Expt 8b - Diffraction of sound Expt 8c - Interference of sound Interference of sound Sound wave through air Expt 8d - Speed of sound in air Expt 8e - Audible range of frequencies Expt 8f - Musical notes Bird flute Expt 8g - Analyzing sounds **Simulations :** Amplitude of longitudinal waves Wavelength of longitudinal waves Frequency of longitudinal waves Audible sound Fundamental frequency and overtones Quality of sound	Book 3B P.186 – 192 No.7, 12, 20, physics in articles 1 Chapter Test (Ch7 – 8)	Book 3B Ch8.1-8.4 Student learning Center	To be aware of the potential health hazards of a prolonged exposure to extreme noise and to make an effort to reduce noise-related disturbances to neighbours

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12/3 – 23/3	**Electric charges** **<u>Electric potential</u>**	1. Examine the evidence for two kinds of charges in nature 2. Realise the attraction and repulsion between charges 3. State Coulomb's law 4. Interpret charging in terms of electron transfer 5. Solve problems involving forces between point charges 6. Use the convention that the electric potential energy at infinity is zero 7. Define the electric potential at a point as the electric potential energy per unit charge of a positive test charge placed at that point 8. State the electric potential around a point charge and solve related problems 9. Derive E = V/d for parallel plates and solve related problems 10. Relate electric field strength to the negative gradient of potential	10		Investigating the nature of the electric field surrounding charges and between parallel plates	Book 4 P.45 No.5, 7, 9(b), physics in articles Chapter Test (Ch 1)	Book 4 Ch 1.1-1.3 Student learning Center	

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26/3 – 30/3	**Electric current** **Electrical energy and electromotive force**	1. Define electric current as the rate of flow of electric charges 2. State the convention for the direction of electric current 3. Describe the energy transformations in electric circuits 4. Define the potential difference (p.d.) between two points in a circuit as the electric potential energy converted to other forms per unit charge passing between the points outside the source 5. Define the electromotive force (e.m.f.) of a source as the energy imparted by the source per unit charge passing through it	6		Measuring current, e.m.f., and potential difference around the circuit by using appropriate meters and calculating the resistance of any unknown resistors		Book 2 Ch 2.1-2.2 Student learning Center	
2/4 – 20/4	**Resistance**	1. Define resistance R = V/I 2. Describe the variation of current with applied p.d. in metal wires, electrolytes, filament lamps and diodes 3. Realise Ohm's law as a special case of resistance behaviour	8		Determining factors affecting the resistance of a resistor Verifying Ohm's law by finding the relationship between p.d. across a	Book 4 P.103 No.1, 6,14, 16 Chapter Test (Ch 2)	Book 4 Ch 2.3-2.5 Student learning Center	

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		4. Determine the factors affecting the resistance of a wire and define its resistivity 5. Describe the effect of temperature on resistance of metals and semiconductors			resistor and current passing through it			
	Series and parallel circuits	6. Compare series and parallel circuits in terms of p.d. across the components of each circuit and the current through them 7. Derive the resistance combinations in series and parallel						
	Simple circuits	8. Measure I, V and R and solve problems in simple circuits 9. Assign the electrical potential of any earthed points as zero 10. Compare the e.m.f. of a source and the terminal voltage across the source experimentally and relate the difference to the internal resistance of the source 11. Explain the effects of resistance of ammeters and voltmeters on measurements			Designing and constructing an electric circuit to perform a simple function			

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23/4 – 2/5	**Electrical power** **Domestic electricity**	1. Examine the heating effect when a current passes through a conductor 2. Apply P = VI to solve problems 3. Use kilowatt-hour (kW h) as a unit of electrical energy 4. Calculate the costs of running various electrical appliances 5. Understand household wiring and discuss safety aspects of domestic electricity 6. Determine the operating current for electrical appliances 7. Discuss the choice of power cables and fuses for electrical appliances based on the power rating 8. Determine the power rating of electrical appliances	8		Investigating the need for and the functioning of circuit breakers in household circuits Identifying hazardous situations and safety precautions in everyday uses of electrical appliances	Book 4 P.141 No.1, 5, 9, 12 Chapter Test (Ch 3)	Book 4 Ch 3.1-3.4 Student learning Center	The views of some environmentalists on the necessity to return to a more primitive or natural lifestyle with minimum reliance on technology
3/5 – 18/5	**Magnetic force and magnetic field**	1. Realise the attraction and repulsion between magnetic poles 2. Examine the magnetic field in the region around a magnet 3. Describe the behaviour of a compass in a magnetic field 4. Represent magnetic field using field lines	14		Using computer simulations to observe and investigate the electric field and magnetic field	Book 4 P.209 No. 1, 8, 10, 15 Chapter Test (Ch 4)	Book 4 Ch 4.1-4.4 Student learning Center	

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	Magnetic effect of electric current	5. Realise the existence of a magnetic field due to moving charges or electric currents 6. Examine the magnetic field patterns associated with currents through a long straight wire, a circular coil and a long solenoid 7. Apply $B = \mu_0 I/2\pi r$ and $B = \mu_0 nI$ to represent the magnetic fields around a long straight wire, and inside a long solenoid carrying current, and solve related problems 8. Examine the factors affecting the strength of an electromagnet			Investigating the magnetic fields around electric currents			
	Current-carrying conductor in magnetic field	9. Examine the existence of a force on a current-carrying conductor in a magnetic field and determine the relative directions of force, field and current 10. Determine the factors affecting the force on a straight current-carrying wire in a magnetic field and represent the force by $F = IlB \sin \theta$			Performing demonstrations to show the relative directions of motion, force and field in electromagnetic devices			

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	Hall effect	11. Define ampere in terms of the force between currents in long straight parallel wires 12. Determine the turning effect on a current-carrying coil in a magnetic field 13. Describe the structure of a simple d.c. motor and how it works 14. Solve problems involving current-carrying conductors in a magnetic field 15. Derive the relation $I = nAvQ$ between electron drift velocity and current 16. Represent the force on a moving charge in a magnetic field by F = BQV sin θ 17. Derive Hall voltage 18. Examine magnetic fields using a Hall probe 19. Apply I = navQ, F = Bqv sin θ and V_H = BI/nQt to solve problems			Constructing electric motor kits and generator kits			

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21/5 – 29/5	**Electromagnetic induction**	1. Examine induced e.m.f. resulting from a moving conductor in a steady magnetic field or a stationary conductor in a changing magnetic field 2. Apply Lenz's law to determine the direction of induced e.m.f./current 3. Define magnetic flux 4. Interpret magnetic field B as magnetic flux density 5. State Faraday's Law and apply it to calculate the average induced e.m.f. 6. Examine magnetic field using a search coil 7. Describe the structures of simple d.c. and a.c. generators and how they work 8. Discuss the occurrence and practical uses of eddy currents	8		**Demonstration or Video :** Expt 5a - Relative movement of conductor and magnet Expt 5b - Moving a conductor across a steady magnetic field Expt 5c - Investigating induced e.m.f. in a coil using data-logger Motor-dynamo unit Shake-shake torch Expt 5d - Measuring magnetic field using a search coil Expt 5d - Measuring magnetic field using a search coil Expt 5e - Eddy current The induction cooker **Simulations :** Lenz's Law Induced current in a rotating coil Simple a.c. generator Simple d.c. generator	Book 4 P.249 No.4, 6, 12 Chapter Test (Ch 5)	Book 4 Ch 5.1-5.2 Student learning Center	
30/5 – 7/6	**<u>Alternating currents (a.c.)</u>**	1. Distinguish between direct currents (d.c.) and alternating currents (a.c.) 2. Define r.m.s. of an alternating current as the steady d.c. which	8		**Demonstration or Video :** Expt 6a - Current and e.m.f. produced by a small a.c. generator (dynamo) Expt 6b - The effective values of alternating current and voltage Expt 6c - Simple transformer	Book 4 P.285 No.3, 5 Chapter Test (Ch 6)	Book 4 Ch 6.1-6.2 Student learning Center	The effects on health of living near high-power transmission cables

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	Transformer **High voltage transmission of electrical energy**	converts electric potential energy to other forms in a given pure resistance at the same rate as that of the a.c. 3. Relate the r.m.s. and peak values of an a.c. 4. Describe the structure of a simple transformer and how it works 5. Relate the voltage ratio to turn ratio and apply it to solve problems 6. Examine methods for improving the efficiency of a transformer 7. Discuss the advantages of transmission of electrical energy with a.c. at high voltages 8. - describe various stages of stepping up and down of the voltage in a grid system for power transmission			Expt 6d - Measuring the voltage ratio of a transformer Expt 6e - The model power line Model of transmission power line **Simulations :** Mutual inductance Simple transformer			
8/6 – 25/6	**Final Examination**							
26/6 – 29/6	**Exam Evaluation**							

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