Surigao City Campus

Bachelor of Science in Electrical Engineering

SURIGAO STATE COLLEGE OF TECHNOLOGY

# SSCT

"For Nation's Greater Heights"

# PARAMETER C

# ASSESSMENT OF ACADEMIC PERFORMANCE

# SYSTEM – INPUTS AND PROCESSES

S.1. The program of studies has a system of evaluating the student performance through a combination of the following:

Surigao City Campus

SURIGAO STATE COLLEGE OF TECHNOLOGY

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Bachelor of Science in Electrical Engineering

S.1.1. formative tests such as quizzes, units tests;

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BSEE-1A

**MODULE #5**

**QUESTIONS**

**Part - A and Part – B**

1. **Define wave motion.**

   - Wave motion refers to the traveling pattern of motion exhibited by a wave, combining both oscillatory motion and forward motion. The general types of waves are mechanical waves, electromagnetic waves, quantum matter waves, and gravitational waves.

**2. Define transverse wave motion.**

- If the particles of the medium vibrate perpendicular to the direction of propagation of the wave, the wave is known as transverse wave.

**3. Define longitudinal wave motion.**

- If the particles of the medium vibrate parallel to the direction of propagation of the wave, the wave is known as longitudinal wave.

**4. Define progressive wave.**

- If a wave travels continuously in a medium without any disturbance, then the wave is said to be progressive wave. Longitudinal waves and Transverse waves are two types of progressive waves and they can travel continuously in any medium if there is no obstruction.

**5. Define amplitude of a wave.**

- When sound wave propagates in a medium, the maximum displacement of the vibrating particles of the medium from their mean position is called amplitude.

**6. Define wavelength of a wave.**

- The wavelength is the distance between two consecutive particles of the medium which are in the same state of vibration. It is also defined as the distance travelled by the wave during the time the vibrating particle completes one vibration.

**7. Define period of wave motion.**

- The time taken by the vibrating particle to make one vibration is called period.

**8. Define frequency of a wave.**

- The frequency is the number of vibrations made by the vibrating particle in one second.

**9. Define velocity of sound wave.**

- The distance travelled by the sound wave in one second is known as velocity of sound.

**10. Define stationary wave.**

- If a progressive wave travelling in a medium meets the surface of an obstacle, it is reflected. The reflected wave is superimposed on the incident wave to form a new type of wave called stationary wave.

**11. Define free vibrations.**

- The vibrations of any body with its natural frequency are called free vibrations.

**12. Define forced vibrations.**

- The vibrations of a body with a frequency induces vibrations on another vibrating agent are called forced vibrations. Suppose a vibrating tuning fork is placed with its stem on a table, the vibrations of the fork are impressed on the table and the table is forced to vibrate. The vibrations set up on the table are called forced vibrations.

**13. Define Resonance.**

- When the forced vibrations given on the body is equal to its natural frequency of vibrations, the body vibrates with maximum amplitude. This phenomenon is called resonance.

**14. State any one of the laws of transverse vibrations in stretched strings.**

**I Law :** The frequency of vibrating string is inversely proportional to its length, when the tension and linear density of the string are kept constant.

**15. What is the use of a sonometer?**

- The phenomenon of resonance is used in sonometer. In sonometer, the frequency of a tuning fork is equal to the frequency of the vibrating string. Here resonance takes place and the string vibrates with maximum amplitude.

**16. What is an echo?**

- The direct sound from the source and the reflected sound (echo) from the walls produce confusion in certain buildings. A hall with large number of open windows is free from the defect. Echoes can be eliminated by making the walls rough. But in the case of musical hall, however echoes are desirable, to a certain extent.

**17. What is reverberation?**

- The sound produced in a hall suffers multiple reflections before it becomes inaudible. As a result of these reflections, the listener continues to receive sound, even if the source of sound is cut off. This prolonged reflection of sound in a room even after the sound source has been stopped is called reverberation.

**18. What is reverberation time?**

- If a building is to be acoustically correct, its reverberation time must be in optimum level. It should not be too long or too short. if it is too short, then the room becomes dead in sound aspect. If it is too long, then the reverberation will be there inside the building for long duration. The reverberation produces continuous sound with decreasing intensity upto a particular time after that it disappears. This time is known as reverberation time.

**19. Write sabine's formula.**

$$T = \frac{0.16\,V}{\alpha\,A}\ \text{second}$$

**20. Define co-efficient of absorption of sound energy.**

- The co-efficient of absorption of sound energy of any surface is defined as the ratio of the sound energy absorbed by the surface to the total sound energy incident on the surface.

**21. Define Pole Strength.**

- The pole strength of a magnet is defined as the force acting on the pole when it is placed in a uniform magnetic field of unit intensity.

**22. Define magnetic induction.**

- The magnetic induction or magnetic flux density is defined as the total number of magnetic lines of force passing normally, through unit area of cross section.

**23. Define intensity of magnetic field.**

- The intensity of the magnetic field at a point in a magnetic field is defined as the force experienced by a unit north pole placed at that point.

**24. Define permeability.**

- The magnetic permeability of the medium (material) is the ratio of the magnetic induction in the medium to the intensity of magnetic field.

**25. Define magnetic moment of a magnet.**

- Magnetic moment of a magnet is defined as the moment of the couple acting on a magnet when it is placed perpendicular to a uniform magnetic field of unit intensity.

**26. Define intensity of magnetisation.**

- Intensity of magnetisation of a magnet is defined as the magnetic moment per unit volume of the magnet.

**27. Define Hysteresis.**

- The lagging in intensity of magnetisation behind the magnetising field is known as hysteresis.

**28. Define Retentivity**

- Retentivity or residual magnetism is the amount of intensity of magnetisation retained in the material after removing the magnetising field.

**29. Define coercivity**

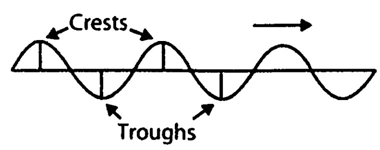
- Coercivity or coercive force is the amount of magnetising field applied in the reverse direction to remove the residual magnetism completely from the material.

**30. Define magnetic saturation.**

- When the magnetising field is increased, the intensity of magnetisation induced in the material also increases up to a particular value. After that the intensity of magnetisation is not increased even though the magnetising field is increased. Now the material attains the saturation value of intensity of magnetisation.

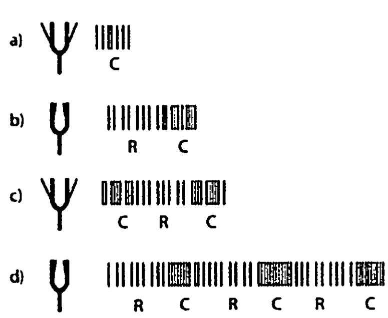
**31. Explain transverse wave motion.**

The transverse waves travel in a medium in the form of crests and troughs. The points where the particles of the medium displaced maximum in the upward direction are called crests. The points where the particles displaced maximum in the downward direction are called. troughs




The crests and troughs produced by the transverse wave motion are as shown in the figure. In transverse wave, alternate crests and troughs are transmitted in the medium. As a result, the particles of the medium move up and down about their mean position perpendicular to the direction of propagation of the wave.

32. Explain longitudinal wave motion.

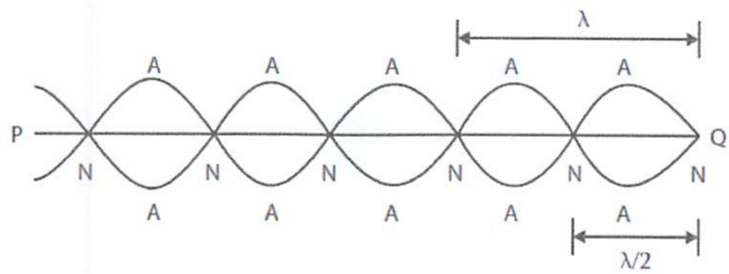



The longitudinal waves travel in a medium in the form of compressions and rarefactions. The place where the particles of the medium crowded together are called compressions and the places where the particles spread out are called rarefactions. The compressions and rarefactions produced by a vibrating tuning fork are as shown in the figure. When the prong (arm) of the fork moves to the right, it compresses the medium in front of it to form compression. Meanwhile the prong returns to the left, a temporarily vacuum is created there. To fill it, the particles of the medium spread out in that place to form a rarefaction. Thus as the prong of the fork vibrates to and fro, alternate compressions and rarefactions are transmitted in the medium. As a result, the particles of the medium simply move back and forth about their mean position parallel to the direction of the propagation of the wave.

**33. Explain stationary wave**

A stationary wave formed by a vibrating string is as shown in the figure. Consider a string P Q fixed at the end Q and it vibrates up and down at the free end P. Then a transverse wave is setup and it proceeds towards the fixed point Q and gets reflected back to the end P. Now the stationary wave is formed in the string.

At certain points of the medium, the displacement due to the two waves cancel each other and those points remain at rest. Such points are called nodes (N). At certain other points there is maximum displacement. Such points are called antinodes (A). The distance between two successive nodes or antinodes is $\lambda / 2$.




The distance between a node and the next antinode is $\lambda / 4$

The longitudinal waves also produce the stationary waves.

**34. Explain the laws of transvers vibration of stretched string.**

According to above laws,

$$n \propto \frac{1}{l}\sqrt{\frac{T}{m}} \quad \text{(or )} \quad n = k\frac{1}{l}\sqrt{\frac{T}{m}}$$

Where k – is a constant and its value is equal to ½.

$$\therefore\ n \propto \frac{1}{2l}\sqrt{\frac{T}{m}}$$

$$\text{If } (\because T = Mg) = \frac{1}{2l}\sqrt{\frac{Mg}{m}}$$

$$n = \frac{1}{2}\sqrt{\left(\frac{M}{l^2}\right)\frac{g}{m}}$$

Note: The linear density,

$$m = \frac{\text{mass}}{\text{length}} = \frac{\text{Volume} \times \text{density}}{\text{length}} = \frac{\pi r^2 l \rho}{l} = \pi r^2 \rho$$

**35. What are the important factor of good acoustics.**

- Echo and Reverberation.

**36. Explain noise pollution.**

- The unwanted sounds which are dumped into the atmosphere, thus producing a nuisance and adverse effect on the health of human beings, are known as noise pollution. Noise pollution leads to severe health problems by creating either physical or mental problems. As a result, it affects the working efficiency, personal comfort, and in some cases, it may lead to industrial accidents. There are varieties of noises such as domestic noise, traffic noise, aircraft noise, etc.

**37. Explain resonance.**

- When a vibrating tuning fork is kept on a table, the table is forced to vibrate with the frequency of the tuning fork. If the natural frequency of the table is equal to the frequency of the tuning fork, the table vibrates with its natural frequency and hence resonance occurs.

**38. Explain Hysteresis.**

In electrical method, a magnetic material can be magnetised by keeping it inside an insulated coil (solenoid) through which a current is passed. Before passing the current, the magnetising field around the coil is zero. Then there is no magnetism induced in the material. If the magnetising field H is gradually increased by increasing the current 'I' the intensity of magnetisation induced in the material also increases up to a particular value. After that the intensity of magnetisation is not increased even though the magnetising field is increased. Now the material is said to be saturated.

If the magnetising field is gradually decreased to zero value, the intensity of magnetisation in the material also decreases but not to zero value. There is a tendency in the material to retain some amount of magnetism. Then, if the field is increased in the reverse direction from zero value, for a particular value the retained magnetism in the material is removed completely. Further increasing the field, the material attained the saturated value of magnetism in the reverse direction and so on.

**39. Write the uses of hysteresis loop.**

- The retentivity of soft iron (OB) is more than that for steel (OB'). So, soft iron retains more magnetism than steel. But the coercivity for soft iron (OC) is less than the coercivity for steel (OC'). So the strength of the magnetic field needed to remove the residual magnetism in soft iron is less than in steel. That means it is easy to remove the residual magnetism in soft iron than steel. Hence steel retains the magnetism during long period. For the above reasons steel is used for permanent magnets and soft iron is used for temporary magnets and electromagnets.

## Part – C

1. **Explain transverse wave motion and longitudinal wave motion.**

   The transverse waves travel in a medium in the form of crests and troughs. The points where the particles of the medium displaced maximum in the upward direction are called crests. The points where the particles displaced maximum in the downward direction are called troughs.

   The longitudinal waves travel in a medium in the form of compressions and rarefactions. The place where the particles of the medium crowded together are called compressions and the places where the particles spread out are called rarefactions.

**2. Distinguish between transverse and longitudinal wave motion.**

The particles of the medium vibrate perpendicular to the direction of propagation of the wave, the wave is known as transverse wave. The particles of the medium vibrate parallel to the direction of propagation of the wave, the wave is known as longitudinal wave.

**3. Explain the laws of transverse vibrations in a stretched string and obtain the expression for the frequency of vibration.**

According to above laws,

$$n \propto \frac{1}{l}\sqrt{\frac{T}{m}} \quad \text{(or )} \qquad n = k\frac{1}{l}\sqrt{\frac{T}{m}}$$

Where k – is a constant and its value is equal to ½.

$$\therefore\ n \propto \frac{1}{2l}\sqrt{\frac{T}{m}}$$

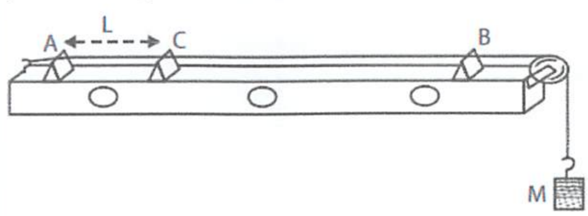
$$\text{If}\,(\therefore T = Mg) = \frac{1}{2l}\sqrt{\frac{Mg}{m}}$$

$$n = \frac{1}{2}\sqrt{\left(\frac{M}{l^2}\right)\frac{g}{m}}$$

Note: The linear density,

$$m = \frac{\text{mass}}{\text{length}} = \frac{\text{Volume} \times \text{density}}{\text{length}} = \frac{\pi r^2 l\rho}{l} = \pi r^2 \rho$$

**4. Describe how the frequency of a tuning fork is determined using a sonometer.**




The sonometer consists of a hollow wooden box. A nail is fixed at one end and a smooth pulley is fixed at the other end of the box. One end of a sonometer string is tied to the nail and other end of the string passes over the smooth pulley. The free end is attached to the weight hanger. A, B and C are three knife edges placed on the box under the string. A, B are fixed and C is movable.

A suitable tension (T = Mg) is applied to the string. A small paper rider is placed on the string in between A and C. The tuning fork of frequency 'n' is excited with a rubber hammer and its stem is kept on the sonometer box. Now the string is made to vibrate. The movable knife-edge C is adjusted such that the string vibrates with the same frequency of the fork. At that time, the paper rider placed on the string between A and C, is violently thrown off from the string. Now the vibrating length of the string AC= l is measured.

**5. Write a note on acoustics of buildings.**

1. The sound heard by the audience should be sufficiently loud in any part of the hall.
2. The quality of the speech and music should not be changed any where inside the hall.
3. There should not be focusing of sound due to walls and ceiling, in any part of the hall.
4. There should not be any vibrations due to resonance.
5. There should not be any other noise from other sources, both from outside the hall and from with in the hall.

**6. Explain noise pollution and the methods of controlling industrial noise.**

The unwanted sounds which are dumped into the atmosphere, thus producing a nuisance and adverse effect on the health of human beings, are known as noise pollution. Noise pollution leads to severe health problems by creating either physical or mental problems. As a result, it affects the working efficiency, personal comfort, and in some cases it may lead to industrial accidents. There are varieties of noises such as domestic noise, traffic noise, aircraft noise, etc. Even though the sources of noise are numerous, the types of sources of noise are generally classified into two types.

(i) Industrial noises and (ii) Non- industrial noises

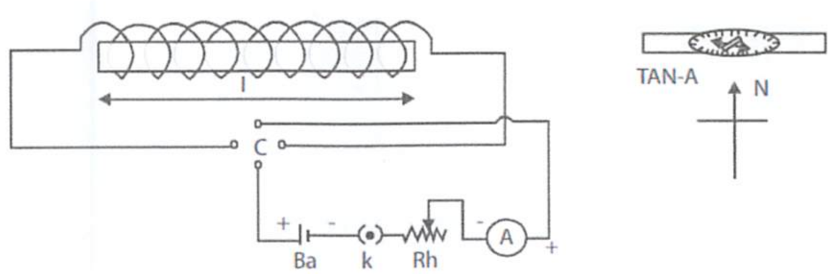
The noises which are produced due to the movements of car, motor truck, motor cycle, aircraft, machines, explosions, etc. are known as industrial noises. The noises which are produced due to the loudspeaker, construction work, radio, etc. are known as non-industrial noises. The industrial and non-industrial noises are generally measured by using the sound pressure level in decibel (dB).

**7. Describe the method of drawing hysteresis loop of a specimen using a solenoid.**

The experimental arrangement is shown in the figure. A long solenoid is connected in a circuit. The direction of the current can be reversed by using a commutator C. The given specimen in the form of a rod is placed inside the solenoid. A deflection magnetometer is placed in Tan-A position at a short distance along the axis of the rod. The deflection magnetometer is adjusted zero position.

The intensity of magnetic field H can be calculated by using the formula $H = (NI) / L$, where N is the number of turns in the solenoid, 'I' the strength of the current passing through the solenoid and L, the length of the solenoid. The value of I can be measured by using ammeter. The intensity of magnetisation

M induced in the specimen can be calculated by using the formula $M = k \tan \theta / V$ where k is constant, $\theta$ is the deflection in the magnetometer and V is the volume of the magnet.



**8. Explain and uses of hysteresis loop.**

The hysteresis loops are very useful in the selection of magnetic materials for permanent and temporary magnets and other industrial purposes. The hysteresis loops for different materials are compared to one another and then the materials are selected for suitable purposes.

For example, let ABCDEFA be the hysteresis loop for soft iron and A' B' C' D' E' F' A' the hysteresis loop for steel. Here the area of the hysteresis loop for steel is more than that of soft iron. Therefore the loss of energy is more in steel than that in soft iron. Hence the quantity of heat emitted by steel is more than that by soft iron. For this reason soft iron is selected as a core materials for transformers, chokes, AC motors, dynamos, etc.

**EXERCISE PROBLEMS**

1. A sonometer wire of 0.5 m long gives vibrations of 256 Hz when stretched with a load of 5 kg. Find the linear density of the material of the wire.

1.) Given: $T = Mg = 5 \times 9.8\ N$

$L = 0.5m$

$n = 256\ Hz$

$m = ?$

Solution: $n = \frac{1}{2L}\sqrt{\frac{T}{m}}$

$256 = \left(\frac{1}{2 \times 0.5}\right)\sqrt{\frac{5 \times 9.8}{m}}$

$256 = \left(\frac{1}{4} \times \sqrt{\frac{5 \times 9.8}{m}}\right)$

$256 = \frac{1}{4}\sqrt{\frac{49}{m}}$

$256 = \frac{1}{4} \times \frac{7}{m}$

$\frac{256}{1} = \frac{7}{4m}$

$\frac{1024 m}{1024} = \frac{7}{1024}$

$m = \frac{7}{1024}$ $= 0.0068\ kg/m$

or $6.8 \times 10^{-3}$ kg/m

**2. Find the frequency of sound produced by a string 25 cm long stretched by load of 5 kg. The linear density of the wire is 4.9 × 10-3 kgm-1**

2.) Given: $T = Mg = 5 \times 9.8\,N$ $\qquad n = ?$

$L = 25 \times 10^{-3}\,m$

$m = 4.9 \times 10^{-3}\,kgm^{-1}$

Solution: $n = \frac{1}{2L}\sqrt{\frac{T}{m}}$

$$n = \frac{1}{2 \times 25 \times 10^{-3}}\left(\sqrt{\frac{5 \times 9.8}{4.9 \times 10^{-3}}}\right)$$

$$= \frac{25}{2} \times 10^{-3}\left(\sqrt{\frac{5 \times 49/5}{4.9 \times 10^{-3}}}\right)$$

$$= \frac{25}{2} \times 10^{-3}\left(\sqrt{\frac{49 \times 10^{3}}{49/10}}\right)$$

$$= \frac{25}{2} \times 10^{-3}\left(\sqrt{10^{4}}\right)$$

$$= \frac{25}{2} \times 10^{-3} \times 10^{2}$$

$$\boxed{= 1.25\ Hz}$$

**BRAIN TEASER**

1. **Thunder was heard 6 second after a flash of lighting was seen. If the velocity of sound is 345ms-1, calculate the distance at which flash occurred.**

Given: $V = 345\ ms^{-1}$

$T = 6s$

$\lambda = ?$

Solution: $V = \frac{\lambda}{T}$

$345 m/s = \frac{\lambda}{6s}$

$\boxed{\lambda = 2070m}$

2. **Two magnetic poles, one of which is twice stronger than the other repel one another with a force of 2 × 10-5 N when kept separated at a distance of 20 cm in air. Calculate the strength of each pole.**

2.) Given: $F = 2 \times 10^{-5}$ N

$m_2 = 2m$

$m_1 = m$

$r = 20cm \rightarrow 0.2$ m

$m_1 = 2m_2$

Solution:

$$F = \frac{\mu_0}{4\pi} \frac{m_1 m_2}{r^2}$$

$$2 \times 10^{-5} = \frac{4\pi \times 10^{-7}}{4\pi} \frac{m \times 2m}{0.2^2}$$

$$m^2 = \frac{2 \times 10^{-5}}{2} \times \frac{4\pi}{4\pi \times 10^{-7}} \times (0.2)^2$$

$$\sqrt{m^2} = \sqrt{4}$$

$m = 2$ Am

$$\begin{cases} m_1 = m = 2 \text{ Am} \\ m_2 = 2m = 4 \text{ Am} \end{cases}$$

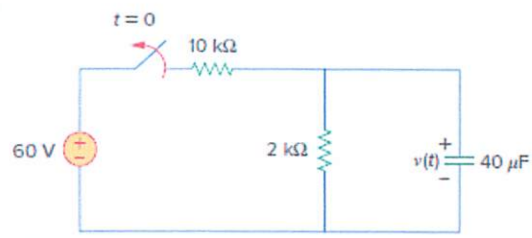
**Post – Test**

**Module 5 – Analysis of RL and RC Circuits**

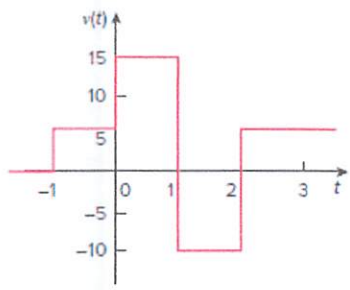
**Name:** **Subject:**
**Course/Section:** **Date:**

Direction: Read the problems carefully. Write your solutions in a separate sheet of paper.

1. The switch in the figure shown has been closed for a long time, and it opens at $t = 0$. Find $v(t)$ for $t \geq 0$.

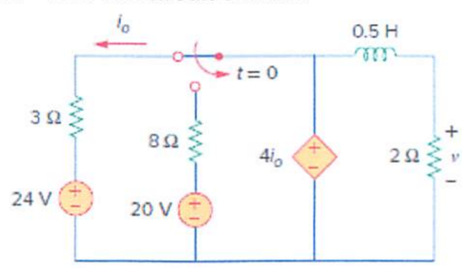



2. Express $v(t)$ in the figure shown below in terms of step functions.

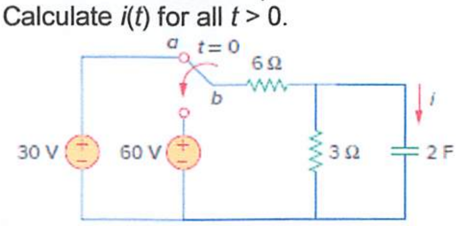



3. Sketch the waveform represented by $i(t) = [r(t) - r(t-1) - u(t-2) - r(t-2) + r(t-3) + u(t)(t-4)]$ A

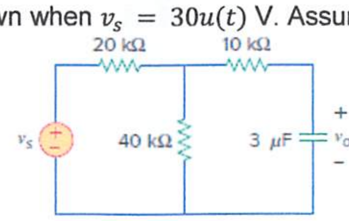
4. Find $v(t)$ for $t < 0$ and $t > 0$ in the circuit shown.




5. The switch in the figure below has been in position *a* for a long time. At $t = 0$, it moves to position *b*. Calculate $i(t)$ for all $t > 0$.




6. Find $v_o$ in the circuit shown when $v_s = 30u(t)$ V. Assume that $v_o(0) = 5$ V.



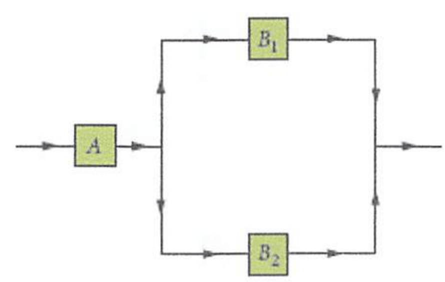
**Post – Test**

**Module 2 – Probability**

**Name:** **Subject:**
**Course/Section:** **Date:**

Direction: Read the problems carefully. Write your solutions in a separate sheet of paper.

1. Suppose components $A$, $B_1$ , and $B_2$ operate independently in an electronic system shown below. Let the probability that each of the components will operate for 10 days without failure be $P(A) = 0.9$, $P(B_1) = 0.8$, and $P(B_2) = 0.7$. The system works if $A$ works and either $B_1$ or $B_2$ works. Find the probability that the entire system will operate without failure for 10 days. Assume that all the components in the system start running at the same time and a component does not work again once it fails.




2. In a certain company, 40% of the employees are females. Suppose 60% of the male workers are married and 40% of the female workers are married. What is the probability that a married worker is male?
3. Jessa is taking statistics and physics courses on Mondays. She is late for the physics class with probability 0.4 and late for the statistics class with probability 0.3. Suppose the two events are independent.
   a. What is the probability that Jessa is late for at least one of the classes?
   b. What is the probability that Jessa is on time to both the classes?
   c. What is the probability that Jessa is on time to exactly one of the classes?
4. Let A and B be events such that P(A) = 0.7 and P(A  B) = 0.6.
   a. What is the largest possible value of P(A ∩ B)?
   b. What is the largest possible value of P(A ∪ B)?
   c. What is the smallest possible value of P(A ∩ B)?
   d. What is the smallest possible value of P(A ∪ B)?
5. Among the 640 employees in a company, 60% of males and 50% of females are married. If a randomly selected employee is married, the probability that this person is a male is double the probability that this person is a female. What is the number of female employees in this company?
6. A ball numbered 1, two balls numbered 2, and three balls numbered 3 are in a

jar. A ball is randomly chosen from the jar twice and the numbers written on the balls are recorded. Find the probability that the total of the two numbers is 4 if

a. the ball from the first pick is returned to the jar before the second pick.
b. the ball from the first pick is not returned to the jar before the second pick.

7. For two events A and B, the probability that A occurs is 0.6, the probability that B occurs is 0.5, and the probability that both occur is 0.3. Given that B occurred, what is the probability that A also occurred?