

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: BE103

Course Name: INTRODUCTION TO SUSTAINABLE ENGINEERING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

Marks

- 1 a1) Justify, giving one reason, why sustainability is an essential component in any developmental programmes and projects. (2)
- a2) Comment on any one challenge experienced in the implementation of sustainable development principles. (3)

OR

- b1) "Keep cool, carry on: The Montreal Protocol" is the theme of World Ozone Day 2018. Explain the key features of Montreal Protocol. (2)
- b2) What are the main outcomes of / issues addressed by the following multilateral environment agreements: (3)
- i. Vienna Convention
 - ii. Brundtland Commission Report (1)
 - iii. United Nations Framework Convention on Climate Change (UNFCCC)

- 2 a1) Explain the impact of resource degradation and sustainability in the context of river sand mining in Kerala. (5)

OR

- b1) What are the activities that can be organised in your college/locality to observe 5th June as the World Environmental Day with theme "Climate change"?(5)
- 3 a1) What is Environment Management System (EMS) (2)
- a2) List out functions of EMS. (3)

OR

- b1) What is LCA? Illustrate how LCA can be effectively used in the environmental management of industrial production systems. (5)
- 4 a1) What are the basic features of a sustainable city? (2)
- a2) Does green building more expensive than traditional building? Why? (3)

OR

- b1) List any two materials that can be green substitutes for conventional buildings materials and explain its features. (5)
- 5 a1) Saving one watt of power is cheaper than increasing the supply by one watt. Justify the statement. (2)
- a2) Compare the feasibility of different sources of renewable energy, giving suggestions to KSEB. (3)

OR

- b1) Compare and contrast conventional and nonconventional energy with reference to sustainability. (5)
- 6 a1) Is there a best energy source that will have the minimum environmental impact? Justify your answer (2)
- a2) Categorize the various energy sources in the increasing order of their carbon footprint. (3)

OR

- b1) What is the possibility of using solar energy in a state like Kerala? List out the various supporting and opposing factors (5)
- 7 a1) List top four major challenges faced by cities (2)
- a2) What are the causes of rural-urban migration? How it will affect the urban area? (3)

OR

- b1) How can sustainable urbanization and poverty reduction be related? (5)
- 8 a1) Enumerate the characteristics of slum. (2)
- a2) Slum dwellers strive hard for self- sustenance. How? (3)

OR

- b1) How urbanisation and agriculture causes water scarcity? (5)

PART B

(Read the Stories/Cases/Data set as the case may be, and answer all questions, each full question carries 10 marks.)

Stories/Cases/Data set - 1

(Stories/Cases/Data set)

Sustainable farming practices have become widespread to counter the negative impact caused on the environment and to resource degradation. One such experience is the effort of Babu who has not used any pesticide on his farm. The one-hectare land held by this farmer is free of any disease and pests. No insecticide, fungicide, weedicide and nematicide were used on his farm. Also he observed the emergence of large number of predators and parasites of pathogenic farm organisms. Babu is thrilled seeing the increasing trend of yield from the farms. The crop failure in the neighbourhood villages has made him the promoter of sustainable agriculture practice in the entire region.

Module I

- 9 a) Bring out how Babu has implemented three basic concepts of sustainability in his farming practice. (3)
- b) Identify a major negative environmental impact that Babu could claim to have arrested through his agricultural practice. (3)
- c) How the experiment of Babu is a better solution for our agricultural sector rather than improving/ protecting the yield by using chemicals like Endosulfan in places like Enmakaje Panchayat in Kasaragod. (4)

Stories/Cases/Data set - 2

(Stories/Cases/Data set)

As many nations contemplate whether to ratify the Paris agreement, while global powers appear reluctant to devise solutions to combat drastic climate change, while countries, governments,

NGOs, interest groups and individuals become increasingly involved in addressing this global challenge and as Earth became witness to its hottest months ever recorded in 2016, a small village named Meenangadi in Wayanad District in Kerala quietly became the 1st carbon neutral village in India. Meenangadi Panchayat, which resides in a unique ecosystem in the Western Ghats towards northern Kerala, initiated an ambitious project to become carbon neutral by 2020. The project was initiated on June 5, 2016, as part of World Environment Day and in the past one year with a committed, innovative and strategic method, the panchayat and all its inhabitants have been able to achieve considerable progress towards one of the most enduring missions in the country.

Module II

- 10 a) What is the concept of carbon footprint? Write two methods to reduce the Carbon footprint. (3)
- b) What is carbon neutrality? (3)
- c) Write about the different lifestyle changes and measures to be adopted by this village in the future towards carbon neutrality. (4)

Stories/Cases/Data set - 3

(Stories/Cases/Data set)

Gypsum is one of the major industrial wastes of Fertilisers and Chemicals, Travancore (FACT). They produce Glass Fibre Reinforced Gypsum (GFRG) panels 124mm thick using this. These panels are 3m x 12m in size with longitudinal cavities inside which can be filled with concrete as required and suitable to use as walls or roof slabs of buildings. Researches done in IIT Madras argue that these panels can be used for buildings upto 10 stories with adequate strength and earthquake resistance. Hence, they propose it for mass housing requirements. These prefabricated elements make the building construction fast and cost-effective. This is an innovative technology from environmental, economic, and social point of views.

Module III

- 11 a) Do Life Cycle Impact Assessment for a building using traditional construction material. (3)
- b) Identify two benefits of GFRG approach. (3)
- c) Do Life Cycle Impact Assessment for a GFRG building. (4)

Stories/Cases/Data set - 4

(Stories/Cases/Data set)

Buildings account for a significant proportion of the total energy and carbon emissions worldwide, and play an important role in formulating sustainable development strategies. There is a growing interest in ZEBs (zero energy buildings) in recent years. Several countries have adopted or considering establishing ZEBs as their future building energy targets to help alleviate the problems concerning the depletion of energy resources and the deterioration of the environment. Broadly speaking, ZEBs involve two design strategies – minimizing the need for energy use in buildings (especially for heating and cooling) through EEMs (energy-efficient measures) and adopting RETs (renewable energy and other technologies) to meet the remaining energy needs. This paper reviews the works related to these two strategies. EEMs include building envelopes, internal conditions, and building services systems; RETs cover photovoltaic/building-integrated photovoltaic, wind turbines, solar thermal (solar water heaters), heat pumps, and district heating and cooling. Issues pertaining to sustainable development implications and further research work required are also highlighted. These include life-cycle

cost and environmental impacts, climate change and social policy issues.

Module IV

- 12 a) Explain briefly the concept of Zero Energy Buildings. (3)
- b) Explain the measure that can be adopted to achieve ZEB through renewable energy and other technologies. (3)
- c) Mention some ways to improve energy efficiency of buildings. (4)

Stories/Cases/Data set - 5

(Stories/Cases/Data set)

India has a huge potential to move into a fully renewable electricity system by 2050, owing to an abundance of renewable resources. If only we can optimally leverage sophisticated technologies to harness proactive collaboration with the industry, academia and energy innovation ecosystem, the region can move straight to affordable renewable systems. Such renewable energy systems can work mainly on clean energy, solar energy, wind energy and other new age storage solutions. Solar photovoltaics is the most economical electricity source and batteries satisfy the night-time electricity demand. In addition to covering India's electricity demand for power, such system simulation can also cover for seawater desalination and synthetic natural gas beyond other measures.

Module V

- 13 a) List out five reasons which hinder the development of renewable energy in India. (5)
- b) Is it possible to generate electricity in India from oceans? Justify. (5)

Stories/Cases/Data set -

6 (Stories/Cases/Data set)

Industrial symbiosis thought emerged two decades ago, when researchers observed that waste and energy usage from industrial operations drastically could be decreased by using the waste of one firm as the input of another, and sharing infrastructure such as steam or water processes. Industrial symbiosis takes biological symbiosis as its guiding metaphor, mimicking the symbiotic relationships found in nature, such as the clownfish cleaning the sea anemone in return for protection from predators.

Module VI

- 14 a) Can the concept of industrial symbiosis be adopted in Kerala? Explain. (5)
- b) List out the advantages and disadvantages of industrial symbiosis. (5)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST/SECOND SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: CE100

Course Name: BASICS OF CIVIL ENGINEERING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

Marks

- | | | |
|----|---|-----|
| 1 | List any six types of buildings as per occupancy according to National Building Code. | (3) |
| 2 | Explain the term plinth area, floor area and carpet area. | (3) |
| 3 | What are the advantageous of Total Station over conventional survey instruments? | (3) |
| 4 | Differentiate between plain cement concrete and reinforced cement concrete. | (3) |
| 5 | Describe the functions of foundations. | (3) |
| 6 | Draw neatly the elevation of a one brick thick English Bond. | (3) |
| 7 | What is meant by bearing capacity of soil? | (3) |
| 8 | Differentiate between Elevator and Escalator. | (3) |
| 9 | What are the different types of Air Condition equipment based on location? | (3) |
| 10 | Mention any three points to be kept in mind while preparing site plan for a building. | (3) |

PART B

Answer any eight questions, each carries 6 marks.

- | | | |
|----|---|-----|
| 11 | Mention the different components of a building with neat sketch. Describe the functions of any three components. | (6) |
| 12 | What is meant by setting out of a building? Explain the procedure for setting out of a single room building with neat sketch. | (6) |
| 13 | What is meant by ranging? Describe the procedure adopted in direct ranging. | (6) |
| 14 | The following consecutive readings were taken with a dumpy level. 1.89, 1.14, -1.36, 2.75, 1.02, 1.52, 1.07. The level is shifted after fourth and sixth readings. The reduced level of first point was 100.00. Draw page of level field book and enter the readings on it. Also find the reduced levels of all the points. Use height of instrument method and do necessary checks also. | (6) |

- 15 List the properties of good building bricks. Explain any five. (6)
- 16 What are the factors to be considered while selecting the site for a building? (6)
- 17 What is meant by orientation of a building? Why it is important for building? (6)
- 18 List the different types of cement. Explain any three of them. (6)
- 19 Explain any four market forms of steel. (6)
- 20 What are the different instruments used for a chain surveying? Explain any three. (6)

PART C

Answer any two questions, each carries 11 marks.

- 21 a) Explain any six types of pitched roof with figure. (6)
- b) What is meant by chimney? Mention any three situations at which chimney are preferred. What are the points to be considered While constructing tall chimney? (5)
- 22 a) Explain any four types of shallow foundations with neat figure. (6)
- b) What is meant by Tower? List the different types of tower based on structural action. Describe with at least two sentences. (5)
- 23 a) Explain briefly the concept of intelligent buildings. (6)
- b) Explain the procedure for painting on a wall surface. (5)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION(2019 SCHEME), DECEMBER 2019

Course Code: CYT100

Course Name: ENGINEERING CHEMISTRY



(2019-Scheme)

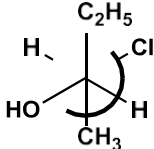
Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

- 1 Calculate the equilibrium constant for the following reaction at 25⁰C:-
 $\text{Fe}_{(s)} + \text{Cu}^{2+}_{(aq)} = \text{Fe}^{2+}_{(aq)} + \text{Cu}_{(s)}$ Given $E^0_{\text{Fe}^{2+}/\text{Fe}} = -0,44 \text{ V}$, $E^0_{\text{Cu}^{2+}/\text{Cu}} = 0.34 \text{ V}$ (3)
- 2 Give the electrochemical reaction taking place when an iron nail is dipped in dil.HCl. $E^0_{\text{Fe}^{2+}/\text{Fe}} = -0,44 \text{ V}$, $E^0_{\text{Fe}^{3+}/\text{Fe}} = -0,04 \text{ V}$, $E^0_{\text{H}^+/\text{H}_2} = 0 \text{ V}$. (3)
- 3 State and explain the law governing absorption of electromagnetic radiation by matter. Give any one limitation of this law. (3)
- 4 Which molecule will absorb at longest wavelength in UV? Explain. (3)
 - a) 
 - b) 
- 5 What are the classifications of chromatography based on physical state of mobile and stationary phases? (3)
- 6 Explain the synthesis of nanoparticles by chemical reduction. (3)
- 7 Write the IUPAC name and assign R/S notation. (3)


- 8 Write the different types of copolymers formed by the monomers A and B. (3)
- 9 Calculate the hardness of (i) 0.05 M AlCl₃ and (ii) 0.04 N MgCl₂. (3)
- 10 What is the significance of measuring BOD of waste water? (3)

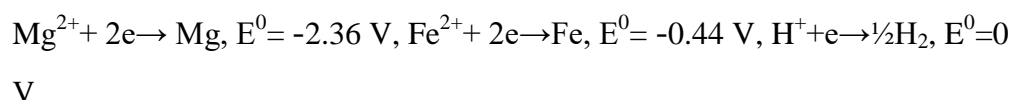
PART B

Answer one full question from each module, each question carries 14 marks

Module-I

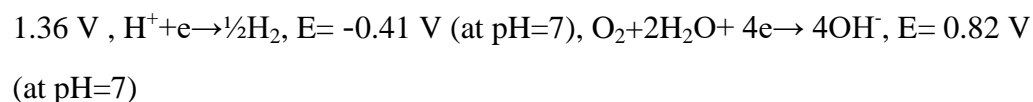
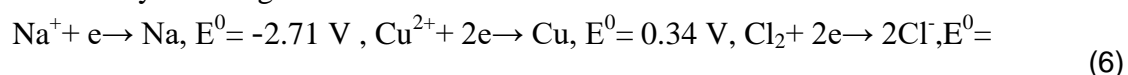
- 11 a) Explain the construction and working of a calomel electrode as a reference electrode. What is the variation in the potential of a calomel electrode with change in chloride ion concentration? (8)

- b) Why Mg corrodes in both acidic and alkaline oxygen deficient conditions, whereas Fe does not corrode in alkaline oxygen deficient condition? (6)



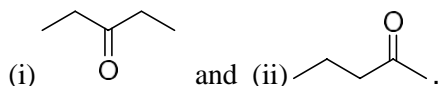
- 12 a) Write the construction, working and advantages of Li-ion cell. (8)

- b) What are the products of electrolysis at cathode and anode when NaCl solution is electrolysed using Cu electrodes.



Module-II

- 13 a) Predict the number of signals, their relative positions and splitting pattern in the nmr spectrum of the following. (8)



- b) Compare the strengths of C-H bond and C=O bond if the absorption frequencies are 3000cm^{-1} and 1700cm^{-1} respectively. (6)

- 14 a) Give the instrumentation of UV spectrophotometer and explain the components in it. Comment on the role of conjugation in the wavelength of absorption with the help of examples. (8)

- b) Briefly explain the principle involved in MRI. Mention any two applications. (6)

Module-III

- 15 a) Discuss in detail the Instrumentation of TG and DTA with neat sketch. (8)

- b) Discuss the various detectors used in GC and HPLC. (6)

- 16 a) Briefly explain the principle, instrumentation and applications of SEM. (8)

- b) Differentiate between TGA and DTA. (6)

Module-IV

- 17 a) Draw and explain the conformational isomerism in ethane and butane. Draw the energy profile diagram. Which conformer is more stable in each case? (10)

- b) Explain the classification of conducting polymers. (4)

- 18 a) What is meant by conformational isomerism? Draw the *cis* and *trans* isomers of 1,4-dimethyl cyclohexane. In each case, mention the more stable conformer. (8)

- b) Brief out the basic principle, construction and working of OLED. (6)

Module-V

- 19 a) Describe the various steps involved in sewage treatment. (10)

- b) Write any four disadvantages of hard water. (4)
- 20 a) Write the principle and procedure of estimation of permanent and temporary hardness of water by complexometric titration. (8)
- b) 50 mL sewage water sample after reaction with 20 mL of $K_2Cr_2O_7$ required 12.4 mL of 0.2 N ferrous ammonium sulphate solution. For blank titration 20 mL $K_2Cr_2O_7$ required 20.4 mL of 0.2 N ferrous ammonium sulphate solution. Calculate the COD of the sample. (6)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EC100

Course Name: BASICS OF ELECTRONICS ENGINEERING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

Marks

- | | | |
|---|--|-----|
| 1 | Explain the different types of variable resistors? Mention their applications. | (5) |
| 2 | What is meant by intrinsic and extrinsic semiconductors? How a P-type semiconductor is formed? | (5) |
| 3 | Explain the working of Zener voltage regulator with a neat diagram. | (5) |
| 4 | Draw the functional block diagram of an operational amplifier. List the parameters of an ideal Op-amp | (5) |
| 5 | Write the expression of an AM and FM signal and explain the terms. | (5) |
| 6 | Explain how modulation reduces antenna height. | (5) |
| 7 | Discuss the major advantages of optical communication system. What are the sources and detectors used in optical fibre communication system? | (5) |
| 8 | What is meant by a DTH system? What are the main features of DTH? | (5) |

PART B

Answer six questions, one full question from each module and carries 10 marks.

Module 1

- | | | |
|---|--|-----|
| 9 | a) Write down the color code for a given resistor of 47-Kilo-ohms with a tolerance of 10%. | (4) |
| | b) Discuss on different types of transformers. | (6) |

OR

- | | | |
|----|---|-----|
| 10 | a) Give brief details of | (5) |
| | (i) Impact of electronics in industry | |
| | (ii) Medical electronics | |
| | b) Draw and explain the construction of a wet electrolytic capacitor. | (5) |

Module 1I

- | | | |
|----|--|-----|
| 11 | a) Sketch the input and output characteristics of common emitter transistor configuration and explain briefly. | (5) |
| | b) Derive the relation between α and β for a transistor. For an <i>npn</i> transistor, | (5) |

$\alpha=0.995$ and $I_E=10\text{m A}$. Find I_B and I_C ?

OR

- 12 Explain the working of LED and photodiode. Draw the necessary figures wherever applicable.. (10)

Module 1II

- 13 a) With necessary diagrams, explain the working of a centre-tapped full wave rectifier. (6)
- b) Compare the ripple factor and efficiency of half-wave, centre-tapped and bridge rectifiers (4)

OR

- 14 a) Write the conditions for sustained oscillations. (2)
- b) Draw the circuit diagram and explain the working of RC phase shift oscillator. Write the expression for its oscillation frequency. (8)

Module 1V

- 15 Explain the generation of various waveforms in a function generator. (10)

OR

- 16 a) Draw the circuit of a non-inverting amplifier and derive the expression for its voltage gain (7)
- b) Design a non-inverting amplifier for a voltage gain of 11 (3)

Module V

- 17 a) What are the advantages and applications of satellite communication? (5)
- b) Explain how the geo-stationary satellite covers full earth? Why are they called so? (5)

OR

- 18 With a neat block diagram, explain the principle and working of superheterodyne receiver. (10)

Module VI

- 19 a) Describe step-index multimode, step-index single mode and graded index multimode fibres. (5)
- b) Explain cable TV network with its block diagram. (5)

OR

- 20 Draw and explain functional block diagram of cellular communication system. (10)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EE100

Course Name: BASICS OF ELECTRICAL ENGINEERING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 4 marks.

Marks

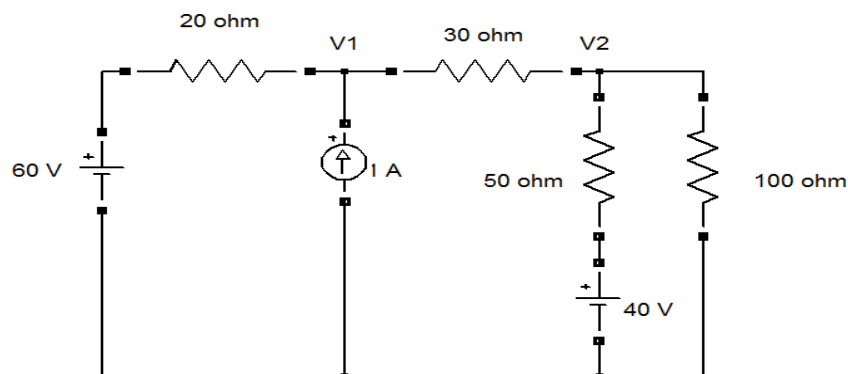
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|----|---|-----|
| 1 | Explain Kirchhoff's voltage and current law with example. | (4) |
| 2 | Compare electric and magnetic circuits. | (4) |
| 3 | Calculate the RMS and average values of a purely sinusoidal current having peak value 15A. | (4) |
| 4 | What is the phase angle relationship between applied ac voltage and circuit current in a purely inductive circuit? Prove your answer. | (4) |
| 5 | What factors are taken in to account while selecting the site for thermal power plant? | (4) |
| 6 | Distinguish between primary transmission and secondary transmission. | (4) |
| 7 | Explain the principle of operation of single phase transformer. | (4) |
| 8 | What is back e.m.f. concerned with DC motors. Write the voltage equation representing back emf. | (4) |
| 9 | Calculate the speed of a 6 pole, 50Hz, 400V 3-phase induction motor when it is operating at a slip of 2%. | (4) |
| 10 | With neat diagram, explain the working of split phase induction motor. | (4) |

PART B

MODULE (1-4)

Answer any four questions, each carries 10 marks.

- | | | |
|----|---|------|
| 11 | Find current in 100 ohm resistor using node analysis. | (10) |
|----|---|------|



- 12 a) A ring shaped electromagnet has an air gap of 6mm and cross sectional area of 12 cm^2 . The mean length of the core (excluding air gap) is 60cm. Calculate the mmf required to produce a flux density of 0.4 Wb/m^2 in the gap. Take the relative permeability of the material as 400. (6)
- b) Derive the expression for energy stored in a magnetic field. (4)
- 13 A balanced three phase load consists of three coils each having resistance of 4Ω and inductance 0.02H. It is connected to a 415V, 50Hz, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the loads are connected in (i) star (ii) delta (10)
- 14 a) A 220V, 50Hz single phase sinusoidal voltage produces a current of 2.2A in a purely inductive coil. Determine (i) inductive reactance of the coil (ii) inductance (iii) power absorbed (iv) expression for applied voltage and current. (5)
- b) With the help of circuit diagram and phasor diagram derive the relation between line and phase voltages, and line and phase currents in a balanced delta connected system. (5)
- 15 Draw a neat schematic diagram of a Thermal power plant and explain its operation. (10)
- 16 Explain about any two types of available Non-conventional energy sources. (10)

MODULE 5

Answer any one full question, each carries 10 marks.

- 17 a) Explain the construction and working of DC generator. (5)
- b) A four pole wave connected armature has 1000 conductors and flux per pole is 0.05wb. Calculate the emf generated when the generator is running at a speed of 1200rpm. (5)
- 18 A 40 kVA transformer has a core loss of 450W and a full load copper loss of 850W. If the power factor of the load is 0.8, calculate (i) full load efficiency (ii) maximum efficiency (iii) the load at which maximum efficiency occurs. (10)

MODULE 6

Answer any one full question, each carries 10 marks.

- 19 Explain the constructional details of squirrel cage and slip ring induction motor (10)
- 20 With suitable diagrams explain the principle of operation of a capacitor-start induction motor. Compare it with split-phase motor. Give one application. (10)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION(2019 SCHEME), DECEMBER 2019

Course Code: EST100

Course Name: ENGINEERING MECHANICS
(2019-Scheme)

Max. Marks: 100

Duration: 3 Hours

PART A

(Answer all questions, each carries 3 marks.)

- 1 A ladder of weight 30 kg is supported at wall and floor as shown in fig 1 below. A man of weight 72 kg stands on it vertically, 8 m above the floor level. There is a 100 kg force acting at top-most point of the ladder vertically. The mass distribution of the ladder is uniform. Considering all contact surfaces smooth, draw the free body diagram. (3)

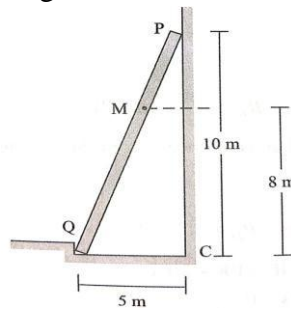
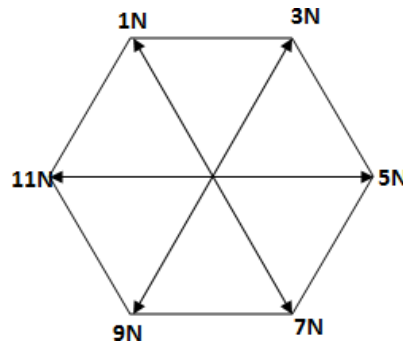


Fig 1

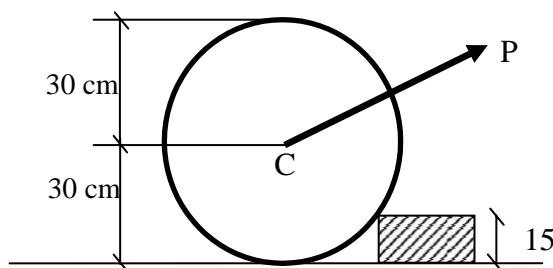
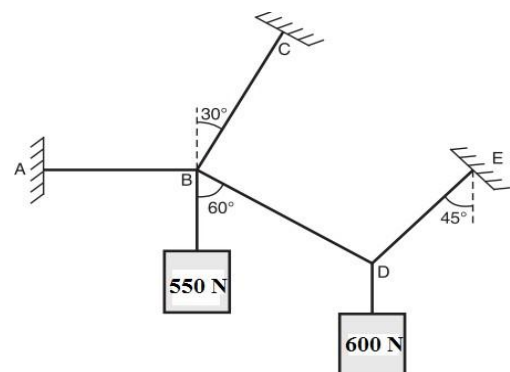
- 2 State and explain Varignon's theorem for concurrent coplanar forces. (3)
- 3 Briefly explain the analysis of forces acting on a wedge with a suitable example. (3)
- 4 A simply supported beam AB of span 4m is carrying point loads 10N, 6N & 4N at 1m, 2m & 3m respectively from support A. Calculate reactions at supports A and B. (3)
- 5 A force $2i+4j-3k$ is applied at the point A(1,1,-2). Find the moment of the force about the point (2,-1,2) (3)
- 6 Calculate the area moment of inertia of a rectangular cross-section of breadth 'b' and depth 'd' about the centroidal horizontal axis. (3)
- 7 A body is projected at an angle such that its horizontal displacement is 3 times that of maximum height. Find the angle of projection. (3)
- 8 The position of a particle moving along a straight line is defined by the relation $x = t^3 - 3t^2 - 9t + 12$ (3)
- Determine the time taken by the particle when its velocity becomes zero.
- 9 A flywheel weighing 500N and having radius of gyration 0.4 m loses its speed from 300rpm to 180 rpm in 1 minute. Calculate the torque acting on it. (3)
- 10 Distinguish damped and undamped free vibrations. (3)

PART B*(Answer one full question from each module, each question carries 14 marks)***Module-I**

- 11 a) A rope 9m long is connected at A and B, two points on the same level, 8m apart. A load of 300N is suspended from a point C on the rope, 3m from A. What load connected to a point D, on the rope, 2m from B is necessary to keep portion CD parallel to AB. (5)
- b) Concurrent forces of 1,3,5,7,9,11 N are applied to the center of a regular hexagon acting towards its vertices as shown in **fig 2**. Determine the magnitude and direction of the resultant. (9)

**Fig 2**

- 12 a) A uniform wheel 60 cm diameter weighing 1000 N rests against a rectangular obstacle 15 cm height as shown in **fig 3**. Find the least force required which when acting through the centre of the wheel will just turn the wheel over the corner of the block. (5)
- b) The system of connected flexible cables shown in **Fig.4** is supporting two loads of 550 N and 600 N at points B and D, respectively. Determine the tensions in the various segments of the cable. (9)

**Fig 3****Fig 4****Module-II**

- 13 a) Find the force required to move a load of 30N up a rough inclined plane, applied parallel to the plane. The inclination of the plane is such that when the same body is kept on a perfectly smooth plane inclined at an angle, a force of 6N applied at an

inclination of 30° to the plane keeps the same in equilibrium. Assume coefficient of friction between the rough plane and the load is equal to 0.3.

- b) For the beam with loading shown in **Fig.5**, determine the reactions at the supports. (7)

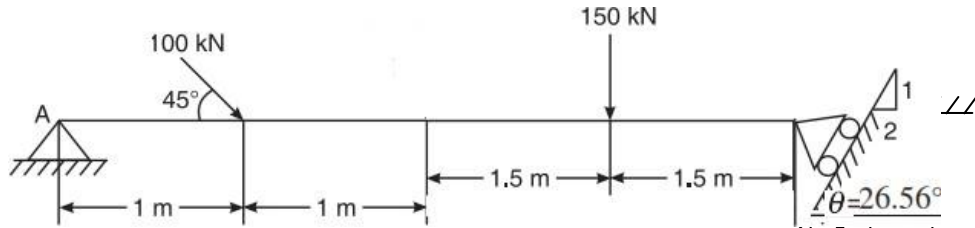
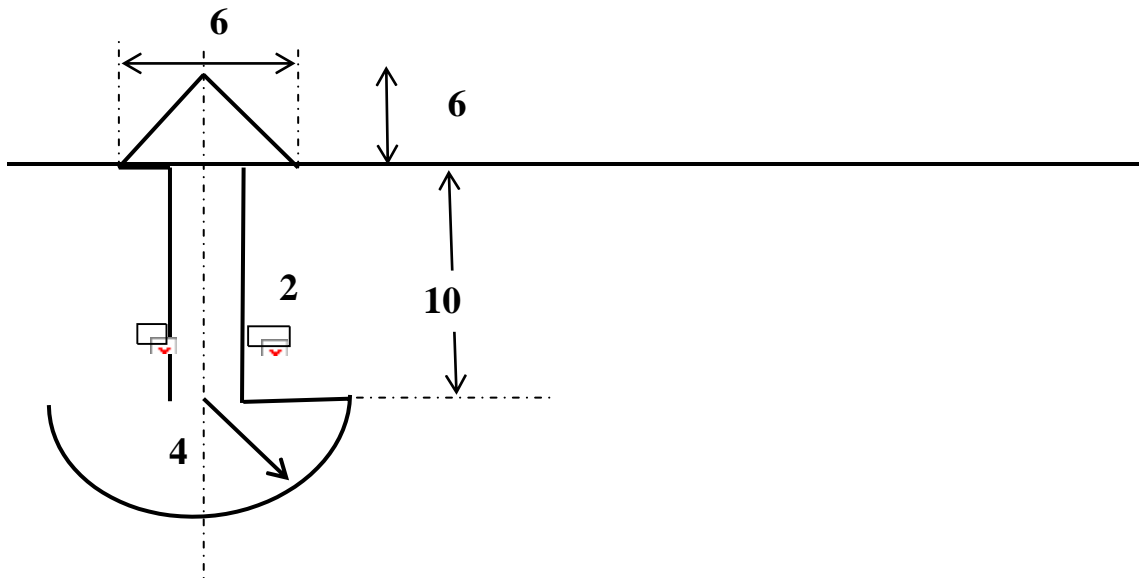


Fig.5

- 14 A uniform ladder 4 m long weighs 200 N. It is placed against a wall making an angle of 60° with the floor. The coefficient of friction between the wall and the ladder is 0.25 and that between the ground and the ladder is 0.35. The ladder in addition to its own weight, has to support a man of 1000 N at the top at B. Calculate: (i) The horizontal force P to be applied to the ladder at the ground level to prevent slipping. (ii) If the force P is not applied, what should be the minimum inclination of the ladder with the horizontal, so that it does not slip with the man at the top? (14)

Module-III

- 15 Find the moment of inertia of shaded area about the horizontal and vertical centroidal axis. All dimensions in cm. (14)



- 16 A force P is directed from a point $A(4,1,4)$ meters towards a point $B(-3,4,1)$ metres. Determine the moment of force P about x and y axis if it produces a moment of 1000Nm about z axis. (14)

Module-IV

- 17 An object of mass 5 kg is projected with a velocity of 20m/s at an angle of 60° to the horizontal. At the highest point of its path the projectile explodes and breaks up into two fragments of masses 1kg and 4kg. The fragments separate horizontally after explosion. The explosion releases internal energy such that KE of the system at the highest point is doubled. Calculate the separation distance between two fragments when they reach the ground. (14)

- C 18 A block of mass M_1 resting on a horizontal plane is connected by a string to another block of mass M_2 as shown in Fig.7. Find the tension in the string and acceleration of the blocks. Assume the coefficient of friction between the blocks M_1 and the plane to be 0.2. $M_1 = 1500\text{N}$, $M_2 = 1000\text{N}$. Angle of inclined plane = 45° . (14)

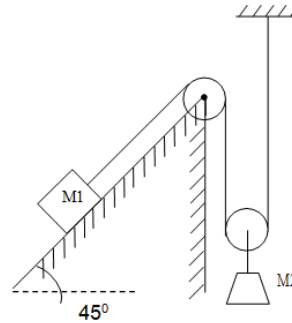


Fig 7

Module-V

- 19 A rotor of an electric motor is uniformly accelerated to a speed of 1800 rpm from rest for 5 seconds and then immediately power is switched off and the motor decelerates uniformly. If the total time elapsed from start to stop is 12.5 sec, determine the number of revolutions made while (a) acceleration (b) deceleration. Also find the value of deceleration. (14)
- 20 a A spring stretches by 0.015m when a 1.75kg object is suspended from its end. How much mass should be attached to the spring so that its frequency of vibration is 3 Hz. (5)
- b A particle moving with simple harmonic motion has velocities 8m/s and 4m/s when at the distance of 1m and 2m from the mean position. Determine (a) amplitude (b) period (c) maximum velocity, and (d) maximum acceleration of the particle. (9)

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: ME100

Course Name: BASICS OF MECHANICAL ENGINEERING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two questions, each carries 15 marks.

Marks

- | | | |
|---|---|------|
| 1 | a) 5 kg of gas contained in a cylinder is fitted with a piston. 150 kJ of heat is transferred to the gas and simultaneously the piston is forced to compress the gas with an expenditure of work equivalent to 100 kJ. Determine the change in specific internal energy of the gas. | (5) |
| | b) Derive an expression for the efficiency of a Carnot cycle. | (10) |
| 2 | a) Explain the term CRDI. | (5) |
| | b) With a neat sketch explain the working of a centrifugal pump. | (10) |
| 3 | a) Explain the working of a reaction hydraulic turbine with a neat sketch. | (7) |
| | b) With a neat sketch explain the working of a 2 stroke petrol engine. | (8) |

PART B

Answer any two questions, each carries 15 marks.

- | | | |
|---|---|------|
| 4 | a) Explain desirable properties required for refrigerants. | (5) |
| | b) With a neat sketch explain the working of a Vapour Compression Refrigeration system. | (10) |
| 5 | a) Derive an expression for the ratio of belt tensions. | (10) |
| | b) Explain the working of a window air conditioner with a neat sketch. | (5) |
| 6 | a) Explain the major components of an automobile. | (5) |
| | b) Derive an expression for the length of an open belt drive. | (10) |

PART C

Answer any two questions, each carries 20 marks.

- | | | |
|---|--|------|
| 7 | a) Explain the function of runner and riser in sand casting. | (5) |
| | b) List out the properties of moulding sand used in sand casting. | (10) |
| | c) Explain different casting defects. | (5) |
| 8 | a) With a neat diagram explain the main parts a lathe. Explain any four operations that can be carried out on a lathe. | (12) |
| | b) Compare up milling and down milling processes with neat diagrams. | (8) |
| 9 | a) State various advantages of CNC machines over conventional machines. | (5) |
| | b) Differentiate between soldering and brazing. | (5) |
| | c) Explain powder metallurgy. What are the different steps involved in powder metallurgy process? | (10) |
